GROUP 7

COOLING SYSTEM AND ACCESSORY BELT DRIVE

PART 1 — COOLING SYSTEM

PART 2 — ACCESSORY BELT DRIVE

SERVICE BULLETIN REFERENCE

Date	Number	Subject	Changes

PART I — COOLING SYSTEM

SPECIFICATIONS

Capacity (Pints)	6 Cyl. 18	V8 Cyl. 29¼
Radiator Type	Tube and spacer	
Transmission oil cooler (with automatic transmission):		
Type	Concentric tube	
Location	Radiator bottom tank	
Radiator Pressure Cap		
Type	Pressure vent	
Pressure setting	14 p.s.i.	
Fan		
Number of blades	6 Cyl. 4	V8 Cyl. 26
Thermostat		
Type	Pellet	
Setting	180°F	
Radiator to fan clearance	½" to 1¼"	
Water pump		
Type	Centrifugal	
Bearing type	Ball bearing	

SPECIAL TOOLS

C-412	Fan hub puller
C-3250	Pliers - radiator hose clip remover
C-3468	Water pump bearing and shaft installing sleeve
C-3499	Pressure testing gauge
C-3514	Flushing gun
CA-3753	Remover - water pump seal

TORQUE SPECIFICATIONS

Water pump bolts	30 lb./ft.
Fan attaching bolts	16 - 18 lb./ft.
Thermostat housing bolts	30 lb./ft.

SERVICE DIAGNOSIS

CONDITIONS — POSSIBLE CAUSES

1. EXTERNAL LEAKAGE .

(1) Loose hose clamp.

(2) Faulty rubber hose.

(3) Leaking radiator.

(4) Worn or damaged water pump seal.

(5) Loose core hole plug.

(6) Damaged gasket or dry gasket, if engine has been stored.

(7) Warped cylinder head.

(8) Cracked cylinder head.

(9) Cylinder head bolts loose, or tightened unevenly.

(10) Cracked cylinder block.

(11) Sandholes or porous condition in block or head.

(12) Leak at water temperature sending unit.

(13) Leak at water pump attaching bolt.

(14) Leak at exhaust manifold stud.

(15) Cracked thermostat housing or mating surfaces not flat.

(16) Dented radiator inlet or outlet tube.

(17) Cracked or porous water pump housing.

2. INTERNAL LEAKAGE

(1) Refer to cases (6) to (11) listed under "External leakage."

(2) Cracked wall.

(3) Cracked valve port.

(4) Crack in block into pushrod compartment.

(5) Crack in head into valve compartment.

3. OVERFLOW LOSS

(1) Refer to causes listed under "Poor Circulation" and "Overheating".

(2) Combustion gas entering system through head gasket or cracked head or block.

(3) Overfilling.

(4) Coolant foaming due to poor quality anti-freeze or corrosion inhibitor.

4. POOR CIRCULATION

(1) Restricted radiator core water passages.

(2) Restricted engine water jacket.

(3) Faulty thermostat.

(4) Low coolant level.

(5) Collapsed radiator hose. (A bottom hose with defective spring may collapse only at high engine speed).

(6) Air leak through loose or defective bottom hose or porous water pump casting.

(7) Water pump impeller broken or loose on shaft.

(8) Fan belt glazed, oil soaked or loose.

(9) Frozen coolant.

5. CORROSION

(1) Use of water containing large concentration of lime and minerals.

(2) Poor quality anti-freeze or corrosion inhibitor.

(3) Use of anti-freeze for extended length of time.

(4) Failure to use corrosion inhibitor.

(5) Low coolant level.

(6) Air leak through loose or defective

bottom hose or porous water pump casting.

(7) Combustion gas leak into coolant.

6. OVERHEATING OR APPARENT OVERHEATING

(1) Refer to causes listed under "Poor Circulation."

(2) Blocked radiator air passages.

(3) Incorrect ignition timing.

(4) Incorrect valve timing.

(5) Low engine oil level.

(6) Tight engine.

(7) Restricted overflow tube.

(8) Faulty radiator pressure cap or seat.

(9) Faulty temperature sending unit.

(10) Restricted muffler, exhaust pipe or tail pipe.

(11) Dragging brakes.

(12) Driving in heavy mud or sand.

(13) Heavy trailer towing on steep grades or at high speeds.

(14) Excessive engine idling.

(15) Inaccurate temperature gauge.

(16) Frozen coolant.

7. OVERCOOLING

(1) Faulty thermostat.

(2) Inaccurate temperature gauge.

SERVICE INFORMATION — PROCEDURES

1. GENERAL INFORMATION

All engines are equipped with 180°F thermostat as standard equipment. With this thermostat, an ethyl-glycol base type anti-freeze may be used. In order to maintain cleanliness, the cooling system should be drained, thoroughly rinsed and filled with the correct coolant in accordance with the lubrication and maintenance schedule.

Always discard old solutions removed. Maximum cleanliness can be assured by using a cooling system cleaner according to the directions on the label. If the system is badly rusted or clogged, it should be pressure flushed.

When draining the cooling system, the block drain plugs should be removed and the radiator drain cock opened. Refill with either rust resistor and water, or anti-freeze and water, (if required).
The quantity of anti-freeze (if required) to be added should be sufficient to protect for the lowest anticipated temperature.

2. PRESSURE TESTING THE COOLING SYSTEM

(1) For testing purposes only, fill radiator to within $\frac{1}{2}$" of filler neck.

(2) Wipe filler neck sealing surface clean.

(3) Attach Tool C-3499 to filler neck and apply 15 p.s.i. pressure (See Fig. 1).

(4) If pressure gauge reading holds steady, the system is satisfactory. If pressure drops, continue test as follows:

(5) Check all points for external leaks. If no external leaks are found after the gauge dial showed a drop in pressure, continue test.

(6) Remove tester and run engine until normal operating temperature is reached.

(7) Re-attach Tool C-3499, apply 7 p.s.i. pressure and increase engine speed to half throttle.

(8) If needle on dial fluctuates, it indicates a combustion leak, generally at the head gasket.

(9) If needle on dial did not fluctuate in step (7), sharply accellerate the engine several times. If an abnormal amount of water emits from the tail pipe, it indicates a head gasket leak, cracked block or cracked head.

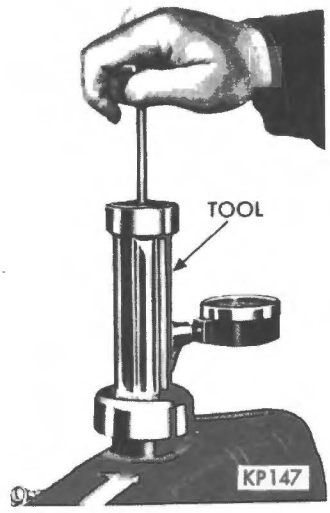


Fig. 1 - Pressure testing the cooling system (Tool C-3499).

3. PRESSURE FLUSHING THE COOLING SYSTEM

(1) Clean the system, using a cooling system cleaner according to the directions on the label.

(2) Drain the radiator and remove both radiator hoses.

(3) Remove the thermostat and re-install the housing.

(4) Connect flushing gun, Tool C-3514, to the engine thermostat housing, using a length of rubber hose.

(5) Install a drain hose in the water pump inlet.

(6) Connect a flushing gun to sources of water and air pressure.

(7) Fill the block with water by restricting the drain hose. Leave the water valve open.

(8) Open and close the air valve to agitate and force away any foreign material. Continue the operation until the water runs clear.

(9) For final block flushing, fill the block with water and remove the drain plugs. Use pressure until the water from the block drains runs clear.

(10) To pressure flush the radiator, disconnect the two hoses from the engine and attach them to the radiator. Attach the flushing gun hose to the lower radiator tank and the drain hose to the top tank.

(11) Fill the radiator with water, leave the water valve open,and open and close the air valve until the water runs clear.

(12) For final radiator flushing, attach flushing gun to top hose and repeat flushing operation.

(13) Test the thermostat (See para. 5). If satisfactory, install with pellet toward engine, using a new gasket.

(14) Install hoses and fill cooling system to 1¼" below filler neck, using water and rust resistor or water and anti-freeze. (if required).

(15) Run engine until the temperature gauge indicates normal operating temperature and continue an additional five minutes to release any air trapped in system. Check coolant level and, if necessary, add additional water.

4. FAN

There are no repairs to be made on the fan. If the fan is bent or damaged, it should be replaced, straightening a bent fan blade greatly reduces its strength and is a dangerous practice.

5. THERMOSTAT

The thermostat is actuated by a pellet, containing a copper-impregnated wax (See Fig. 2). As the temperature of the pellet increases, the wax expands and opens the valve. A 180° thermostat is standard equipment.

If the thermostat does not close completely when cold, the engine will warm up slowly and heater performance may also be inadequate. Poor heater performance may also be due to the valve opening at too low a temperature. Too high a valve opening temperature, or a valve that will not open, can cause overheating.

To Remove

(1) Drain the cooling system down to thermostat level or below.

(2) Remove the upper hose from the thermostat housing using pliers C-3250.

(3) Remove the thermostat housing bolts and remove the thermostat and housing.

To Test

(1) Visually inspect thermostat to make sure valve closes tightly. If valve does not close completely due to dirt, sand, or other foreign material, clean valve and seat. If valve does not close tightly when clean, install a new thermostat.

(2) Open the valve by hand or by heating in water. Insert a $\frac{1}{8}$" wide strip of .003" feeler stock into the opening and allow the valve to close. If the feeler stock will not hold in place, discard the thermostat.

(3) Suspend the thermostat by the feeler stock strip, in a container of water. Make sure the thermostat does not touch the sides or bottom of the container.

(4) Heat the water and stir it continuously (to ensure uniform temperature) and check the water temperature at which the thermostat falls off the feeler strip.

The thermostat should drop off at a water temperature of 175° to 185°.

(5) Continue heating water to approximately 200°. The thermostat should be fully open at this temperature.

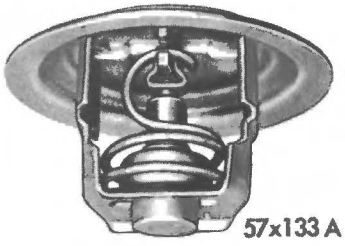


Fig. 2 - Pellet type thermostat.

To Install

(1) Using a new gasket, position the thermostat so that the pellet end is toward the engine, and attach with bolts through the thermostat housing.

(2) Fill the cooling system to $1\frac{1}{4}$" below filler neck with water and rust resistor or water and anti-freeze.

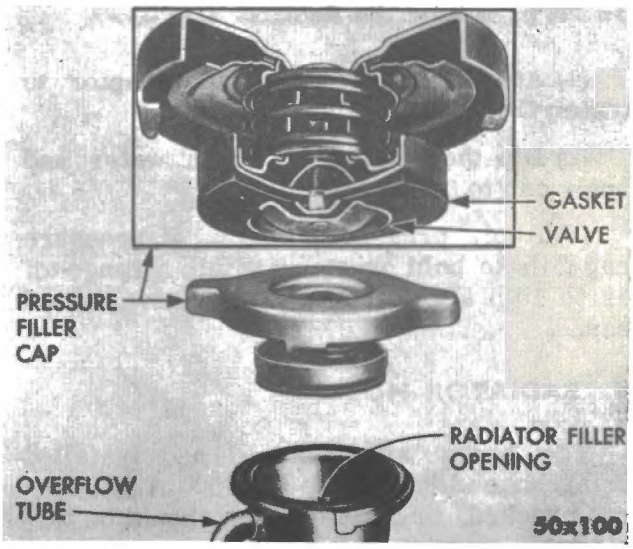


Fig. 3 - Radiator pressure cap.

6. RADIATOR PRESSURE CAP

A 14 p.s.i. pressure-vent type radiator cap (See Fig. 3) is used as standard equipment.

When removing the pressure cap, turn the cap counter-clockwise to the stop, permitting any pressure to be released through the overflow tube.

This will prevent hot water from spraying out of the radiator filler opening. After pausing at the stop, continue turning counter-clockwise until the cap is released.

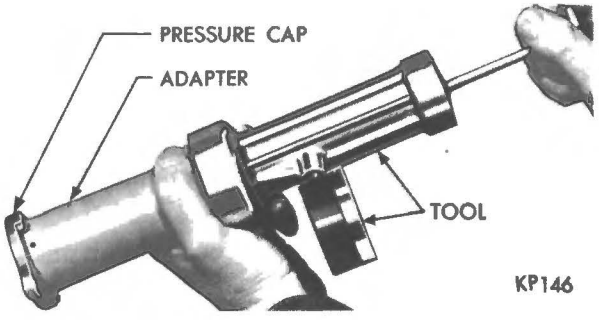


Fig. 4 - Testing the pressure cap (Tool C-3499).

The brass vent valve at the bottom of the cap should hang freely. If the rubber gasket has swollen and prevents the vent valve from hanging loosely the cap should be replaced.

To Pressure Test the Radiator Cap

(1) Attach neoprene seal and adaptor to tester C-3499 (See Fig. 4).

(2) Dip the pressure cap in water and apply cap to tester adaptor.

(3) Apply pressure to cap. If pressure cap fails to hold pressure within a range of 12 to 15 p. s. i., replace with a new, tested cap.

7. RADIATOR HOSES

The hoses are removed and installed using hose clamp pliers C-3250. A hardened, cracked, or swollen hose should be replaced.

The spring inside the lower hose is necessary to prevent collapsing of the hose due to suction at high engine speeds.

If this spring is weak or broken, it should be replaced.

8. RADIATOR

To Remove

(1) Drain the cooling system.

(2) On cars with automatic transmission, disconnect the oil cooler lines at the radiator bottom tank.

(3) Remove radiator hoses (using pliers C-3250) and radiator attaching bolts.

(4) Lift radiator straight up and out of engine compartment.

To Install

(1) Slide the radiator down into position behind the radiator support and install the attaching bolts. Tighten to 75-115 lbs./ins.

(2) Connect hoses, and connect transmission oil cooler lines (if so equipped).

(3) Fill cooling system to $1\frac{1}{4}$" below filler neck with water and rust resistor.

(4) Check the transmission oil level (after warm-up) and add oil as required.

9. TRANSMISSION OIL COOLER

Automatic transmission equipped cars use a transmission oil cooler in the radiator bottom tank. A leaking oil cooler may permit entrance of transmission oil into the cooling system and engine coolant into the transmission.

To Test Oil Coolers for Leaks

(1) Disconnect both oil lines at the radiator.

(2) Attach a pressure gauge to one fitting, and an air line equipped with a shut-off valve to the other fitting.

(3) Coat all fitting joints with oil.

(4) Apply air pressure (up to 100 p. s. i.). Oil bubbles will identify any fitting joint leaks which should be corrected before proceeding with test.

(5) Close valve and check pressure gauge. If pressure drops off, the oil cooler is leaking.

To Service the Oil Cooler

(1) Remove radiator.

(2) Remove radiator bottom tank.

(3) Melt the soft solder holding cooler to tank.

(4) Remove spring nuts holding cooler fittings to tank and remove cooler.

(5) Install new cooler as follows, or repair old cooler with silver solder and reinstall.

(6) Position cooler in tank and apply spring nuts to fittings.

(7) Use soft solder to hold cooler in tank.

(8) Attach bottom tank to radiator using soft solder.

(9) Install the radiator (See para. 8).

10. WATER PUMP 6 CYLINDER

To Remove

(1) Drain the cooling system.

(2) Loosen fan drive belt by loosening alternator mounting bracket and swinging alternator in toward water pump.

(3) Remove fan and pulley.

(4) Remove the water pump to housing retaining bolts and washer and remove water pump from car. Discard gasket.

To Disassemble

Refer to Fig. 5 and proceed as follows:

(1) Break the plastic impeller (See Fig. 9) and remove it from the metal insert.

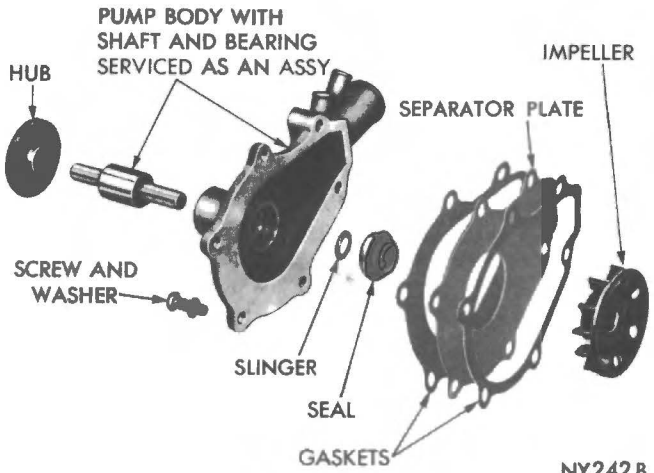


Fig. 5 - Water pump.

(2) Remove the support plate and gaskets.

(3) Split the sintered metal insert of the plastic impeller as follows: Place a $\frac{1}{4}$" ball bearing against one of the grooves on the outer diameter of the insert Position the insert and ball bearing in a vice and apply pressure against the ball bearing (See Fig. 6) until the insert splits. Remove the metal insert.

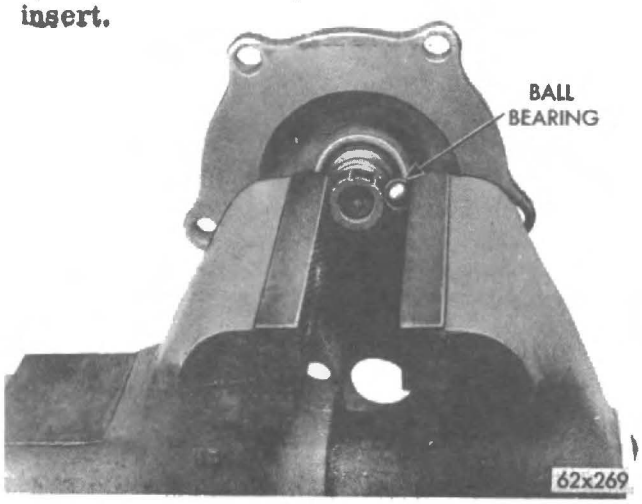


Fig. 6 - Splitting the plastic impeller insert.

(4) Remove the rubber portion of the shaft seal and the spring.

(5) Using Puller Tool CA-3753 (See Fig. 7) remove the retainer portion of the seal.

(6) Remove the fan hub using Puller Tool C-412.

(7) Support the pump body on the front face (fan hub end) and apply pressure to the rear end of the shaft to press the shaft and bearing assembly out through the front of the pump. If an attempt is made to remove the shaft in the opposite direction, damage to the pump body will result.

(8) Use a wire brush to remove all rust from the support plate. Clean all parts with a suitable solvent and dry with compressed air.

Bearing assemblies removed from water pumps should not be re-used, as damage to the bearing will usually occur during removal.

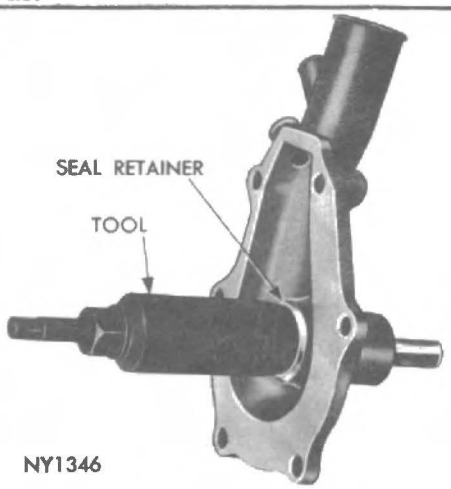


Fig. 7 - Removing seal retainer (Tool CA-3753).

To Assemble

(1) Inspect seal surfaces of the impeller hub to be sure it is free of nicks, burrs, scratches and rust. If necessary remove these blemishes using crocus cloth on a flat plate.

(2) With the pump housing supported at the hub end, use a $1\frac{1}{4}$" (12 point) socket to apply pressure against the outer lip of the seal retainer and press the seal assembly into the body until the retainer lip is against the pump body.

(3) With the thrower ring in position on the long end of the pump shaft (approximately $\frac{1}{8}$" from the bearing assembly) start the shaft and bearing assembly into the fan hub end of the pump body bore.

(4) Use a $1\frac{1}{4}$" (12 point) socket and support the pump body at the seal end and with Tool C-3468, positioned against the outer bearing race only, press the shaft and bearing into the pump body so that the end of the bearing is flush with the body hub end.

(5) Whilst supporting the pump on the impeller end of the shaft, press the fan hub on to the shaft, (flat surface out) so that the shaft extends $\frac{13}{32}$" beyond the fan hub.

(6) Position new gaskets on each side of the support plate and place the plate on the pump body.

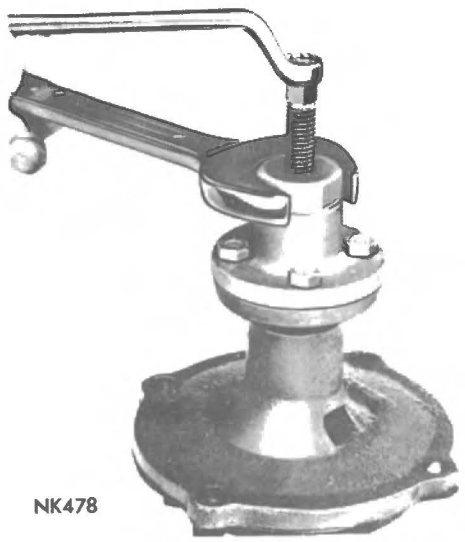


Fig. 8 - Removing the fan hub (Tool C-412).

(7) Clean the seal face and impeller hub seal surface.

(8) Supporting the pump on hub end of shaft, position the new impeller on the pump shaft (blade portion down) and press the impeller on to the shaft until it is flush with the end of the shaft.

The pump bearing outer case must be flush with the front end of the body hub and the impeller must be flush with the shaft end to provide the correct clearance between the impeller blades and the separator plate.

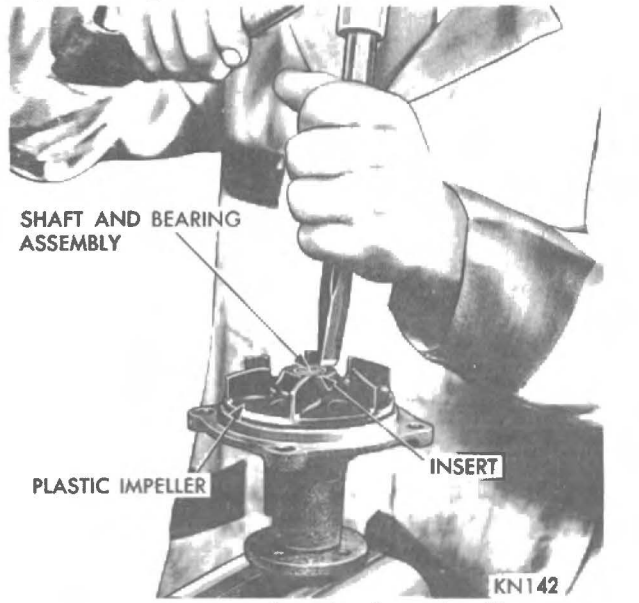


Fig. 9 - Breaking the plastic impeller.

To Install

(1) Use a new gasket and install water pump. Tighten bolts to 30 lbs./ft. torque.

(2) Install pulley and fan. Fill cooling system and check for leaks. Check belt tension as outlined in Part 2. "Accessory Belt Drive."

WATER PUMP (V8 CYLINDER)

I. DISASSEMBLY

Refer to (Fig. 10) and proceed as follows.

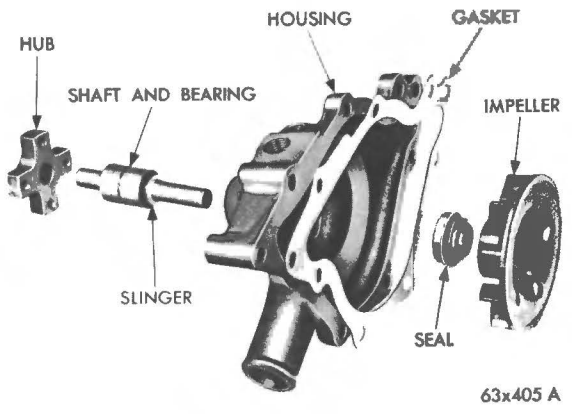


Fig. 10 Water Pump (Exploded View)

(1) Break the plastic impeller and remove it from the metal insert.

(2) Split the sintered metal insert of the plastic impeller with a chisel and hammer.

(3) Remove the rubber portion of the shaft seal and the spring.

(4) Using puller CA-3753 remove the retainer portion of the seal.

(5) Remove the fan hub using puller C-412.

(6) Support the pump body on the front face (fan hub end) and apply pressure to the rear end of the shaft to press the shaft and bearing assembly out through the front of the pump. If an attempt is made to remove the shaft in the opposite direction, damage to the pump body may result.

(7) Use a wire brush to remove all rust from the housing. Clean all parts with a suitable solvent and dry with compressed air. Bearing assemblies removed from water pumps should not be re-used, as damage to the bearing will usually result during removal.

2. ASSEMBLY

Inspect the seal surface of the impeller hub to be sure it is free of nicks, burrs, scratches and rust. If necessary remove these blemishes using crocus cloth on a flat plate.

(1) Apply a thin coat of a suitable sealer to the seal pocket in the pump body.

(2) With the pump housing supported at the hub end, use a $1\frac{1}{4}$ inch (12 point) socket to apply pressure against the outer lip of the seal retainer and press the seal assembly into the body until the retainer lip is against the pump body.

(3) With the slinger ring in position on the long end of the pump shaft (approx. 1/8 inch from the bearing assembly) start the shaft and bearing assembly into the fan hub end of the pump body bore.

(4) Use a $1\frac{1}{4}$ inch (12 point) socket and support the pump body at the seal end, and with Tool C-3468, positioned against the outer bearing race only, press the shaft and bearing into the pump body, so the end of the bearing is flush with the housing.

(5) While supporting the pump on the impeller end of the shaft, press the fan hub onto the shaft so the shaft extends 11/32 inch through the fan hub.

(6) Support the pump on the fan hub end of the shaft and position the new impeller on the pump shaft (blade portion down). Using a tool that will press against the impeller insert only, press the impeller onto the shaft until it is flush with the end of the shaft.

PART 2 — ACCESSORY BELT DRIVE

BELT TENSION SPECIFICATIONS
(Belt Deflection Method)

Deflection (inches) to be applied at midpoint of belt segment under a 5 lb. load (See Fig. 1).

	Used Belt	New Belt
Alternator	1/4"	5/32"

NOTE: Any belt that has operated for a minimum of half an hour is considered to be used.

SERVICE DIAGNOSIS

CONDITIONS — POSSIBLE CAUSES

1. INSUFFICIENT ACCESSORY OUTPUT DUE TO BELT SLIPPAGE

(1) Check belt tension and belt condition.

(2) If belt is excessively glazed or worn, replace and tighten as specified.

2. BELT SQUEAKS WHEN ACCELLERATING ENGINE

(1) Belt too loose - re-tighten.

(2) Belt glazed - replace belt.

3. BELT SQUEAK AT IDLE

(1) Misaligned pulley - align accessories.

(2) Non-uniform groove or eccentric pulley - replace pulley.

(3) Non uniform belt - replace belt.

(4) Dirt and paint embedded in belt - replace belt.

(5) Belt too loose - re-tighten.

4. BELT ROLLED OVER IN GROOVE

(1) Broken cord in belt - replace belt.

5. BELT JUMPS OFF

(1) Belt too loose - re-tighten.

(2) Misaligned pulleys - align accessories.

SERVICE INFORMATION — PROCEDURES

1. CORRECT BELT TENSION

The satisfactory performance of the belt driven accessories depends on the maintenance of correct belt tension. If correct tensions are not maintained (See para. 2), belt slippage may cause engine overheating, reduced alternator charging rates and greatly reduced belt life. To avoid any such adverse effects, the following regular maintenance service should be performed.

(1) Re-tighten belt to the specified used belt tension at new car preparation.

(2) Check belt by the deflection method at each servicing and re-tighten if necessary.

(3) The new belt tension specifications (See para. 2) should be used on all belt replacements and the above procedure followed thereafter.

2. BELT DEFLECTION METHOD

All belts can be tensioned by measuring the deflection of the belt at midpoint between water pump and alternator pulley under a 5 lb. push or pull. A small spring scale can be used to establish the 5 lb. load.

Deflection should be measured at the correct location (See Fig. 1).

To tension the belts by the deflection method, loosen alternator mounting bolts and use a bar to apply tension to the belt, taking care not to damage the alternator.

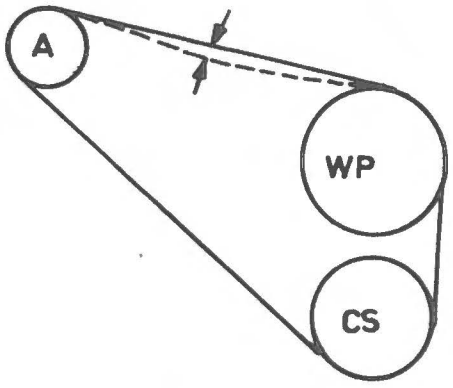


Fig. 1 - Belt deflection location.

Tighten the mounting bolts and check the deflection (see Specifications). It may be necessary to repeat this procedure several times to establish the correct tension. Any belt that has operated for a minimum of half an hour is considered to be used.

GROUP 8

ELECTRICAL SYSTEM

PART 7 — GAUGES AND INSTRUMENTS

AP5 Models

AP6 Models

PART 8 — HEADLAMPS

ELECTRICAL SYSTEM

PART 1 — BATTERY

SPECIFICATIONS

Make	Chrysler
Capacity	50 amp. hr. at 20 hr. discharge rate
Rating	12 volts
No. of Plates	9
Terminal Grounded	Negative
Location	Left hand front splash shield in engine compartment
Type	Reverse assembly

PART 2 — STARTING MOTOR 6 CYLINDER

SPECIFICATIONS

Make	Bosch
Model	AL/EGF 1/12 R11
Rating	12 Volts
No. of fields	4
No. of poles	4
No. of brushes	4
Spring tension	41 - 46 ozs.
End float (armature)	.002" - .012"
Drive	Solenoid actuated positive pre-engaged pinion
Stall test	300 - 350 amps @ 6 volts
No load test	12 volts = 40-50 amps @ 7000-8000 RPM
Load test	9 volts = 190-210 amps @ 1150-1250 RPM
Max. commutator out of round	.002"
Armature brake torque	2.2 to 3.5 lbs./in.
Clutch o/running torque	1.1 to 1.6 lbs./in.
Solenoid pull-in voltage	7 volts

SPECIAL TOOLS

EFAW 10	Mica undercutting machine
EFAW 9	Pole shoe clamp and screwdriver
EF 1244 B	Spring balance - checking brush spring tension
EFAL 1	Pinion bush extractor
EFAL 3	Smoothing mandrel for bushes
EFAL 26	Torque balance (Test range 1.3 to 6.9 lb./in.)
EFAL 27	Torque balance (Test range 0.3 to 1.0 lb./in.)

(Note: Above tools available from Bosch Distributors).

SERVICE DIAGNOSIS — CONDITIONS — POSSIBLE CAUSES

1. STARTER FAILS TO OPERATE, OR TURNS TOO SLOWLY

(1) Battery discharged.

(2) Defective battery.

(3) Battery terminals loose or oxidized; defective earth connection.

(4) Starter terminals or carbon brushes, earth short-circuited.

(5) Carbon brushes of starter have unsatisfactory contact with the commutator, jammed in holders, excessively worn, broken or fouled by dirt or oil.

(6) Starting switch damaged (burnt out, or loose parts impeding switching action).

(7) Excessive voltage drop in circuit, wiring damaged or loose connections.

(8) Neutral starter switch (automatic transmission) faulty.

2. PINION FAILS TO MESH ALTHOUGH ARMATURE ROTATES

(1) Pinion fouled by dirt.

(2) Pinion or ring gear damaged or burred.

3. WHEN STARTER IS OPERATED, ARMATURE ROTATES UNTIL THE PINION IS FRICTIONALLY CONNECTED. THEN STOPS.

(1) Battery charge low.

(2) Insufficient pressure on carbon brushes.

(3) Excessive voltage drop in starter circuit.

(4) Over-running clutch slips.

4. STARTER CONTINUES RUNNING AFTER RELEASE OF STARTING SWITCH

(1) Starting switch fails to cut out, or magnetic switch sticks.

5. PINION FAILS TO DISENGAGE WHEN ENGINE HAS STARTED

(1) Pinion or flywheel gear badly fouled or damaged; release spring fatigued or broken.

SERVICE INFORMATION — PROCEDURES

1. GENERAL INFORMATION

The Bosch AL/EGF 1/12 R11 starter motor is a direct cranking, series parallel wound, four pole, four brush type with solenoid actuated positive pre-engaged pinion operation. The main battery supply is not connected until the pinion is in engagement, unless tooth abutment is experienced. The frictional connection between starter armature and ring gear is automatically broken by the over-running clutch coupling which disengages the drive as soon as the engine speed exceeds that of the starter motor.

Operation

Closing the solenoid switching circuit energises the pull-in and hold-in solenoid windings and the soft iron plunger is drawn in, moving the engaging lever, which in turn moves the drive assembly toward the ring gear. The coarse thread on the armature shaft causes the pinion to rotate and assist in engagement. Should the advancing pinion come up against a tooth, the engaging lever compresses the helical spring at the pinion end until the switch closes. As the pinion is turned it engages with the succeeding tooth space under the helical spring pressure. Before the pinion is completely in mesh the contacts in the solenoid switch are closed by the action of the soft iron plunger, and the starter rotates and cranks the engine. When the starter rotates, the pull-in winding is de-energised by the isolation of its ground connection, providing more starter

current for cranking. As the starting speed of the engine exceeds that of the starter, the pinion rotates freely and engine accelleration does not affect the starter.

The drive being under no load, is pulled back by the tensional helical spring, however, the pinion remains partly engaged as the starter switch is operated. Once the starter switch is released, the plunger return spring returns the pinion to its rest position and opens the switch contacts.

2. ELECTRICAL TESTS OF STARTER MOTOR

The electrical test values depend upon the condition of the battery (capacity and charge). The testing period also plays an important part (heating of the starter, and battery discharge). The unavoidably long cables on the test bench at times also influence starter performance. The test period should therefore be as short as possible. The batteries must be in good condition and well charged or the electrical values of a faulty starter will differ considerably from the specified test data.

(1) Circuit Diagram

The internal wiring of the starter and the electrical hook-up for testing are shown in Fig. 1.

(2) Stall Test

If test bench is available, install starter motor in test bench. Follow instructions of test equipment manufacturer and check stall torque of starter. With the starter locked and battery current applied, quickly note the voltmeter and ammeter readings. Amperage reading should be 300 - 350 amps. at 6 volts.

(3) No Load Test

Mount starter on test bench for free running test. Hook up as shown in test wiring diagram (Fig. 1). Take readings of starter current draw voltage and r.p.m. which should be:

Volts	12
Amps.	40 - 50
R. P. M.	7000 - 8000

(4) Load Test

If test equipment available included provision for carrying out a load test, hook up as in stall test. Operate starter and brake until the prescribed current draw is reached, and read voltage and r.p.m. Readings should be:

Volts	9
Amps.	190 - 210
R. P. M.	1150 - 1250

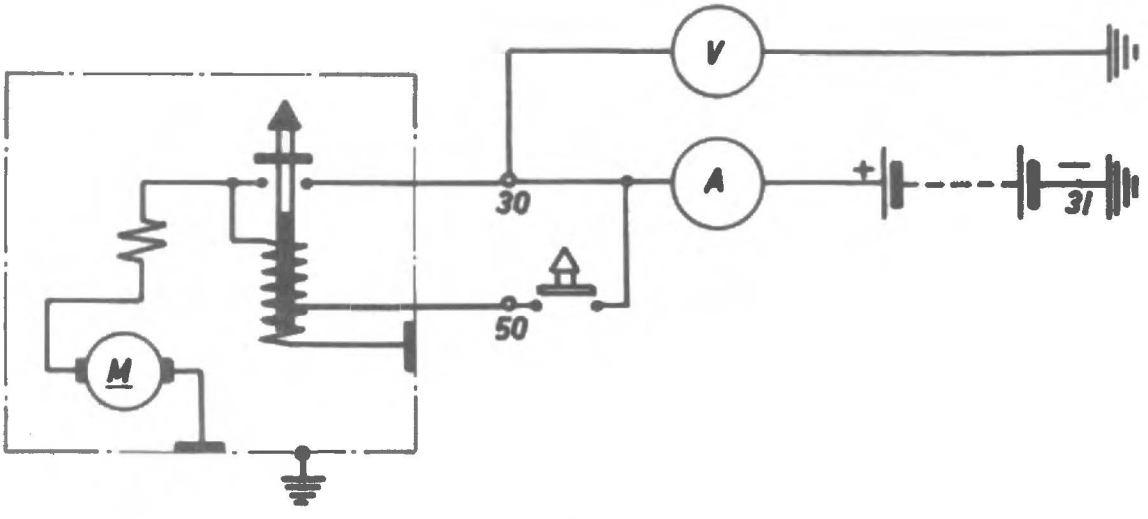


Fig. 1 - Wiring diagram for electrical tests of starter motor.

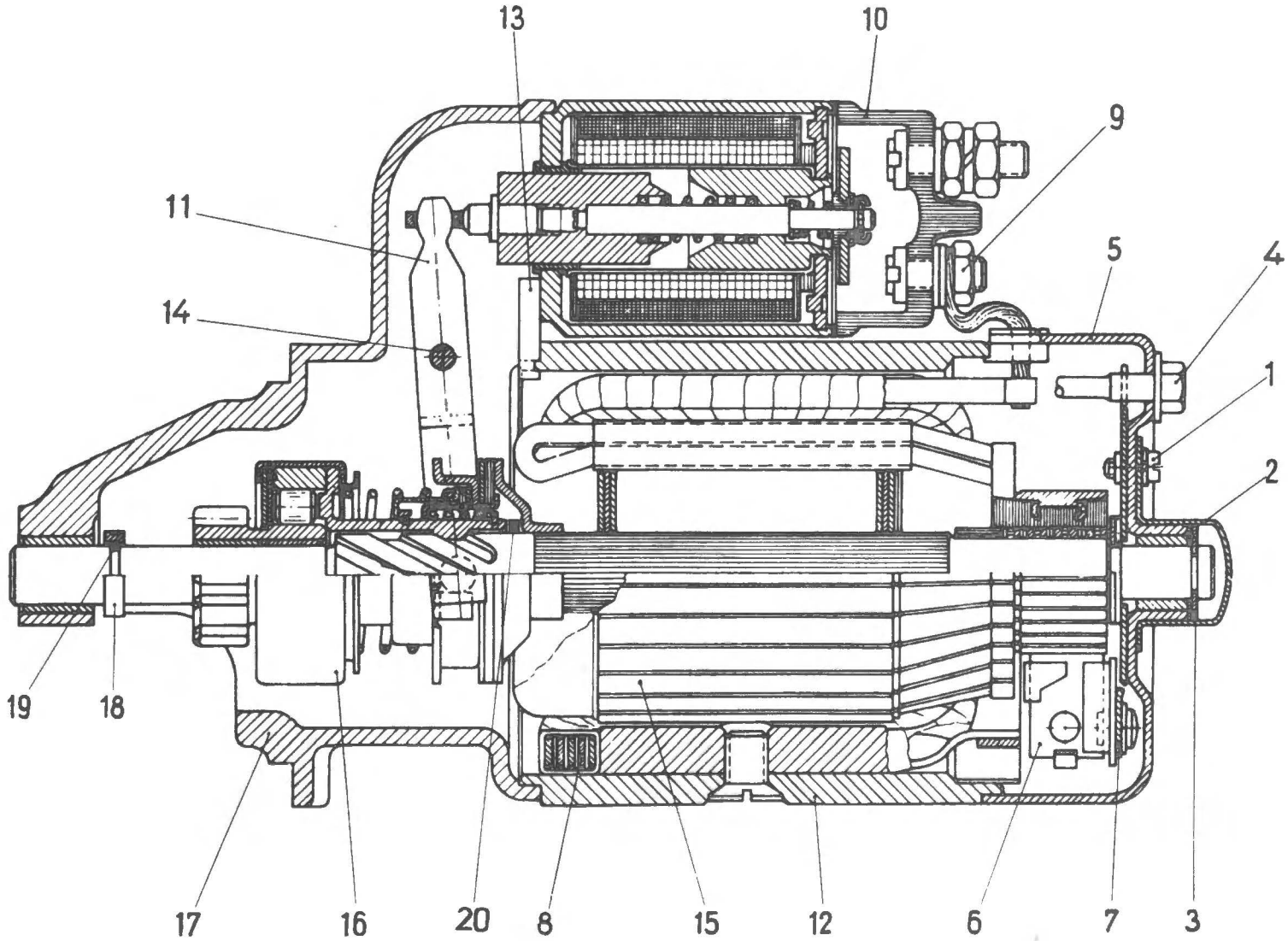


Fig. 2 - Starter motor.

3. SERVICING THE STARTER MOTOR

Disassembly (Refer Fig. 2)

(1) Disconnect the solenoid switch to starter motor lead from the solenoid switch terminal (9).

(2) Remove the two solenoid switch attaching screws.

(3) Remove solenoid (10) by lifting and unhooking the plunger yoke from engaging lever (11).

(4) Remove the two bearing cap screws (1), pull off bearing cap (2), and remove circlip (3).

(5) Remove through bolts (4).

(6) Remove commutator end cover (5).

(7) Remove four brushes (6) and brush brushholder plate (7).

(8) Withdraw armature (15) with drive end housing (17) and engaging lever (11).

(9) Remove engaging lever fulcrum bolt (14) to release engaging lever and armature from drive end housing.

(10) Press stop ring (18) on armature shaft toward drive assembly.

(11) Remove spring ring (19).

(12) Remove drive assembly (16).

Testing Starter Components

(1) General

Replace any damaged parts. Electrical connections (terminal parts) must be in good clean condition. The drive assembly must slide easily on the armature shaft without jamming or binding. Engaging lever should move freely. Replace any bent parts. Re-tap damaged threads.

(2) Field Coils

(a) Field coils should not be burnt or connections unsoldered and should not protrude beyond the poleshoes.

(b) Disconnect all ground connections and connect high voltage test lamp from field winding connection to ground. Test lamp must not light.

(c) Separate field coils at junction and test for open circuits with a low voltage series light. Test lamp must light in continuity test.

(d) Field coils can be removed with an approved pole shoe screwdriver (see Special Bosch Tools).

(3) Armature

(a) The armature must clear both pole shoes and field coils. Check for damage to insulation. The winding must not be larger than the diameter of the armature core.

(b) Check armature windings for short circuits using a growler.

(c) Test armature for grounded windings using a high voltage series lamp.

(4) Commutator

The carbon brushes should show a uniform grey-blue colour and be free from oil or dirt. The commutator should not be erroded or out of round (Max. permissable out-of-round .002"). Should it be necessary to re-dress the commutator, ensure that its minimum diameter specification of $1\frac{5}{16}$" is not exceeded.

Undercut mica between segments to a depth of 1/32" using a ground down hacksaw blade or under cutting machine.

(5) Carbon Brushes

Make sure brushes slide smoothly in their holders, that the brush connections are good, and that the brushes themselves are clean and not chipped. Brushes worn to less than $\frac{1}{2}$" long should be replaced, at which time the commutator must be machined. Always replace the complete brush set with genuine replacement parts. Check brush spring tension according to the prescribed specification of 41 - 46 ozs. Lift brush with spring balance, taking care that balance joins spring at point of contact with

the brush and that the pull is exerted parallel to the brush holder.

Replace weak springs with genuine replacement parts.

(6) Bearings

Replace worn bushings by pressing the old bushing out with a correctly fitting mandrel and press the new bushing into place in a like manner. New sintered bushings should be soaked in oil for one hour before installation.

(7) Solenoid Switch

Remove switch cover fastening screws and inspect contact bolts and contact plate for excess burning. Replace burnt contacts. The thickness of the contacts determines the switching reserve which is the plunger travel from the contact closing point to the fully pulled-in position.

Switch operation can be checked by connecting a battery supply through a variable resistance to both pull-in and hold-in windings and increasing the voltage gradually until at 7 volts the plunger moves into its operational position. The plunger should return to the rest position when the voltage is reduced to from 0.05 - 0.4 volts. A switch not operating according to these specifications must be replaced. Check adjustment of solenoid switch pull rod in its full "pull in" position. This should be $\frac{3}{4}$" from the inside face of the solenoid switch body to the outer edge of the slot in the pull rod which engages the operating lever. Adjustment can be carried out if required, by loosening the locknut and screwing the rod in or out the required amount. Tighten the locknut.

Re-Assembly

Re-assembly is a reversal of disassembly procedure, paying particular attention to ensuring a water tight seal is made at the rubber packing (13). Fig. 2.

Later build starter motors have a rubber buffer (20) fitted to the armature to absorb the return thrust of the drive assembly after disengagement. This rubber buffer should be installed in earlier Bosch starter motors whenever such motors are being overhauled.

4. MECHANICAL ADJUSTMENTS

(1) Armature End Play

Too little or too much end play results in in- creased wear of the bearings.

The end play is adjusted by adding or removing shims at the commutator end between the end cover and circlip on the armature. End play should be .002" to .012".

(2) Armature Braking Torque

The total armature braking torque is the force necessary to turn the armature against brush, bearing, and the auxiliary armature brake resistance. Too high a braking torque results in excessive mechanical wear and armature brake heating. Too low a braking torque results in extended starter stopping time. Also, the starter over-running acceleration will be too high.

Armature torque should be between 2.2 - 3.5 lb./in. and can be measured with a torque balance. (See Bosch Tool List).

(3) Clutch Overrunning Torque

The overrunning torque of the clutch assembly is the force necessary to turn the pinion whilst the armature shaft is held stationary.

Too low an overrunning torque may prevent starter power application. If the overrunning torque is too high, the armature can reach too high a speed and may be damaged.

For measuring overrunning torque, move the pinion forward at least 0.4" with armature stationary and measure torque in direction of rotation. Reading should be 1.1 to 1.6 lb./in. Clutch assemblies not conforming to the specification must be replaced.

PART 2A — STARTING MOTOR — V8 CYLINDER

SPECIFICATIONS

Make and Number	Chrysler
Voltage	12
Poles	4
Fields	4 (3 Series 1 Shunt)
Brushes	4
Brush Spring Tension	32 to 36 ozs.
Drive	Over-running Clutch
End Play	.010" - .045"
Free Running Test :	
Voltage	11
Amp. Draw	90
Minimum speed (RPM)	1925 - 2400
Stall Torque Test:	
Voltage	4
Amp. Draw	400 - 475
Solenoid Switch:	
Pull-in Coil	14.4 - 16.0 amps @ 6.0 volts
Hold-in Coil	11.5 - 12.6 amps @ 6.0 volts

1. GENERAL INFORMATION

The starting motor has an armature-to-engine crankshaft ratio of 45 to 1; a 3.5 to 1 reduction gear set is built into the motor assembly, which is housed in an aluminium die casting. The starting motor utilises a solenoid shift device, the housing of the solenoid is integral with the starting motor drive end housing.

2. STARTER RESISTANCE AND CURRENT DRAW TESTING

(1) Test the battery electrolyte specific gravity. Specific gravity should be 1.220 or above. If the battery specific gravity is below 1.220, recharge the battery to full charge before proceeding with test.

(2) Disconnect the positive battery lead from the battery terminal post. Connect an 0 to 30 scale ammeter between the disconnected lead and the battery terminal

(3) Connect a test voltmeter with 10 volt scale division between the battery positive post and the starter switch terminal at the starter solenoid.

(4) Crank the engine and observe the reading on the voltmeter and ammeter. The voltage should not exceed 0.30 volt. A reading of voltage that exceeds 0.30 volts indicates there is high resistance caused from loose circuit connections, a faulty cable, burned starter relay or solenoid switch contacts. A current that is high and is combined with slow cranking speed, indicates that the starter should be removed and repaired.

3. STARTER GROUND CIRCUIT TEST

(1) Connect the voltmeter positive lead to the starter housing and the negative voltmeter lead to the battery negative post.

(2) Crank the engine with a remote control starter switch and observe the voltmeter reading. The voltmeter reading should not exceed 0.20 volt. A reading of 0.20 volt or less indicates normal voltage in the ground cable and connections. If the voltmeter reading is more than 0.20 volt, it indicates excessive voltage loss in the starter ground circuit. Make the following tests to isolate the point of excessive voltage loss. Repeating the test at each connection.

(a) Starter drive housing.
(b) Cable terminal at the engine.
(c) Cable clamp at the battery.

A small change will occur each time a normal portion of the circuit is removed from the test. A definite change in the voltmeter reading indicates that the last part eliminated in the test is at fault.

Maximum allowable voltage loss is :

Battery ground cable, 0.20 volt.
Engine ground circuit, 0.10 volt.
Each connection, nil volt.

4. STARTING MOTOR BENCH TEST

Free Running Test

(1) Place starter in vice and connect a fully-charged 12 volt battery to starter as follows :

(2) Connect a test ammeter(100 amperes scale) and carbon pile rheostat in series with battery positive post and starter terminal.

(3) Connect a voltmeter(15 volt scale) across starter.

(4) Rotate the carbon pile to full-resistance position.

(5) Connect the battery cable from the battery negative post to the starter frame.

(6) Adjust the rheostat until battery voltage shown on the voltmeter reads 11 volts.

(7) The current draw should be 90 amps max. at 1925-2400 rpm.

Stall Test

(1) Install the starter in test bench.

(2) Follow the instructions of the test equipment manufacturer and test the stall torque of the starter. With applied battery voltage adjusted to 4 volts, the amperage draw should be 400-500 amps.

5. STARTING MOTOR SERVICING

To Disassemble

(1) Place gear housing of the starter in a vice equipped with soft jaws. Use the vice as a support fixture only. DO NOT clamp.

(2) Remove the two through-bolts and the starter end head assembly.

(3) Carefully pull the armature up and out of the gear housing and the starter frame and field assembly and remove the steel and fibre thrust washer.

NOTE: The wire of the shunt field coil is soldered to the brush terminal. One set of brushes are connected to this terminal. The other pair of brushes is attached to the series field coils by means of a terminal screw. Carefully pull the frame and field assembly up just enough to expose the terminal screw and the solder connection of the shunt field at the brush terminal. Place two wood blocks between the starter frame and starter gear housing (see Fig. 4) to facilitate removal of the terminal screw and the unsoldering of the shunt field wire at the brush terminal.

(4) Support the brush terminal by placing a finger behind the terminal and remove the terminal screw. (See Fig. 4).

(5) Unsolder the shunt field coil lead from the starter brush terminal (See Fig. 5).

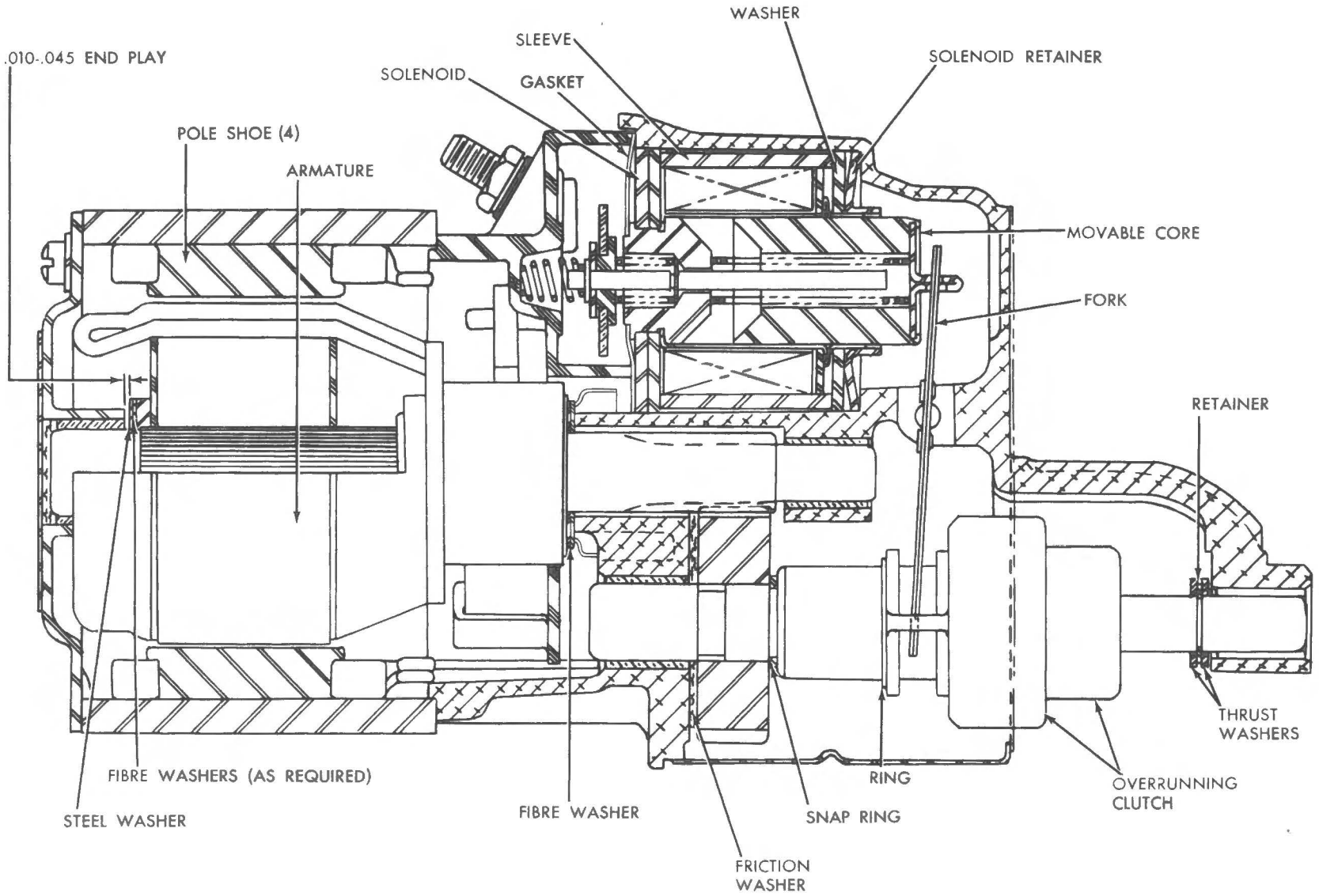


Fig. 3 Starting Motor (Cross-section View)

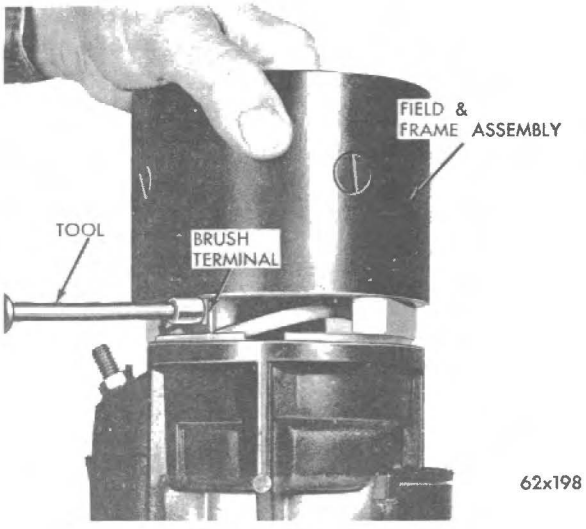


Fig. 4 Removing Brush Terminal Screw

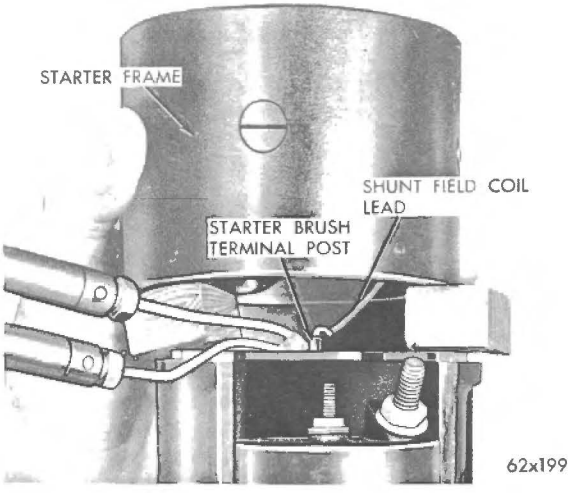


Fig. 5 Unsoldering Shunt Coil Lead Wire

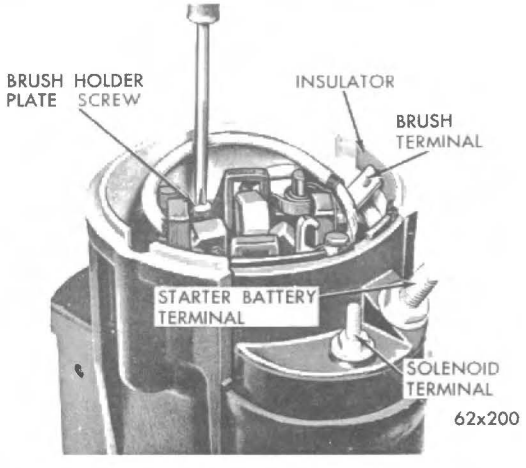


Fig. 6 Removing Brush Holder Plate Screw

(6) Remove the starter brush insulator which prevents contact between the brush terminal and the gear housing. (See Fig. 6).

NOTE: The starter brush holder plate with the starter brush terminal, contact and brushes is are serviced as an assembly.

(7) Remove the screw attaching the brush holder plate to the starter gear housing. (See Fig. 6).

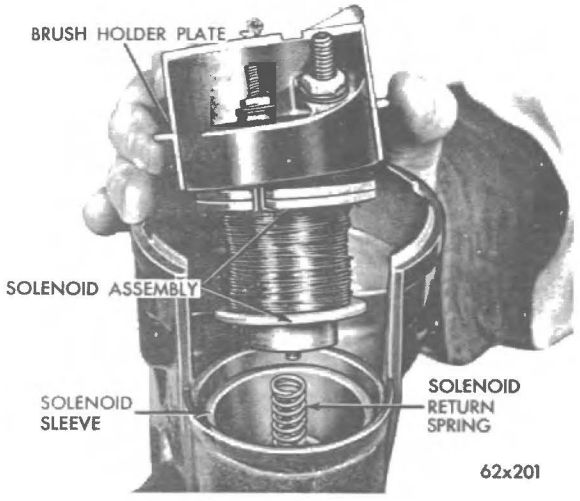


Fig. 7 Removing Brush Holder Plate

(8) Remove the brush holder plate with brushes and solenoid as an assembly (See Fig. 7).

(9) Unsolder the solenoid winding from the starter brush terminal (See Fig. 8).

(10) Remove nut (11/32 wrench), steel washer and nylon washer from solenoid terminal.

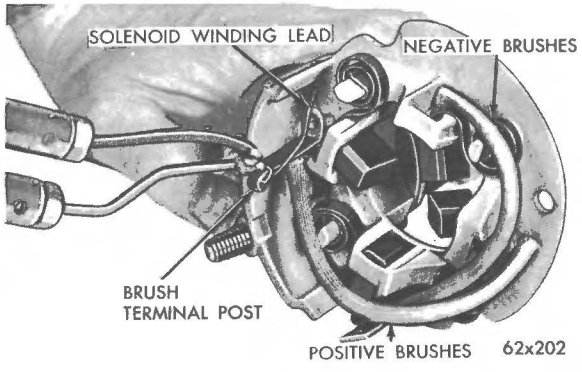


Fig. 8 Unsoldering Solenoid Winding Lead

(11) Separate the brush holder plate from the solenoid (See Fig. 9).

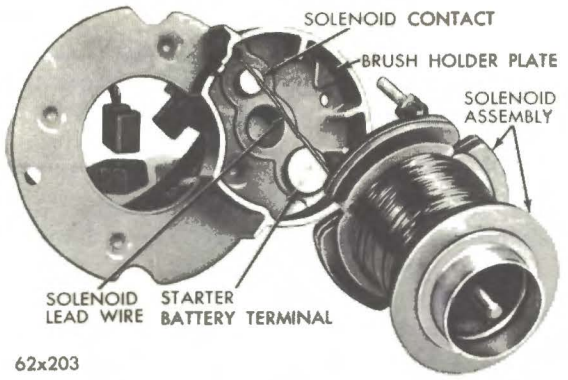


Fig. 9 Separating Solenoid from Brush Holder Plate

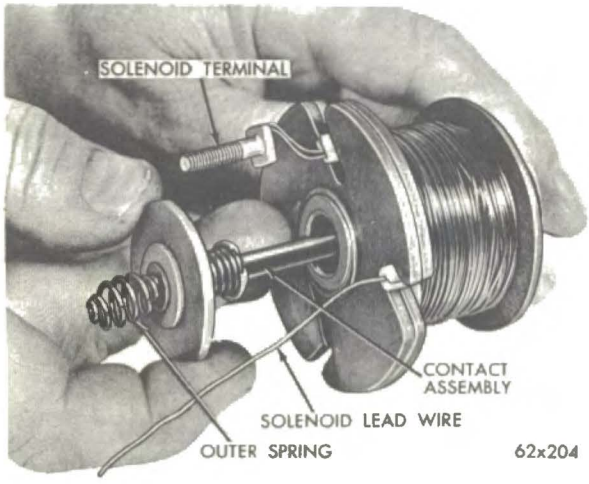


Fig. 10 Removing Contact Assembly

(12) Remove the nut, steel washer and nylon washer from starter battery terminal.

(13) Remove the starter battery terminal from holder plate.

(14) Remove solenoid contact assembly (See Fig. 10).

(15) Remove the solenoid coil sleeve. (See Fig. 11).

(16) Remove the solenoid return spring from well or solenoid housing moving core (See Fig. 7).

(17) Remove the solenoid coil retainer washer and solenoid coil retainer from solenoid housing (See Fig. 12).

Fig. 11 Removing Solenoid Coil Sleeve

Fig. 12 Identification of Solenoid Coil Retainer and Retainer Washer

(18) Remove the dust cover from the gear housing (See Fig. 13).

(19) Release the snap ring that positions the driven gear on the pinion shaft. (See Fig. 14).

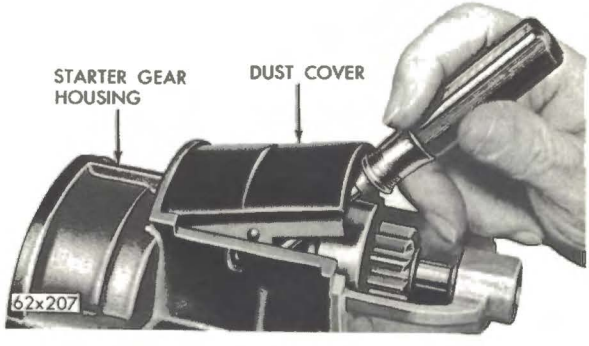


Fig. 13 Removing Dust Cover

CAUTION: The ring is under tension and a cloth should be placed over the ring to prevent it from springing away after removal.

(20) Release the retainer ring at the front of the pinion shaft. (See Fig. 15).

NOTE: Do not spread the retainer ring any greater than the outside diameter of the pinion shaft, otherwise the lock ring can be damaged.

(21) Push the pinion shaft toward the rear of the housing (See Fig. 16) and remove the snap ring and thrust washers, clutch and pinion assembly, with the two shifter nylon actuators (See Fig. 17).

(22) Remove the driven gear and friction washer.

(23) Pull the shifting fork forward and remove the solenoid moving core (See Fig. 18).

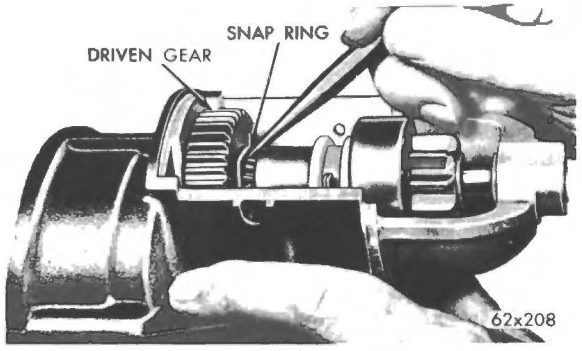


Fig. 14 Removing Driven Gear Snap Ring

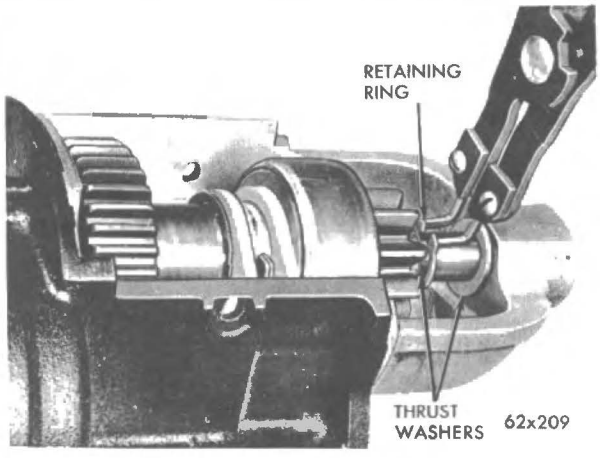


Fig. 15 Removing Pinion Shaft Retainer Ring

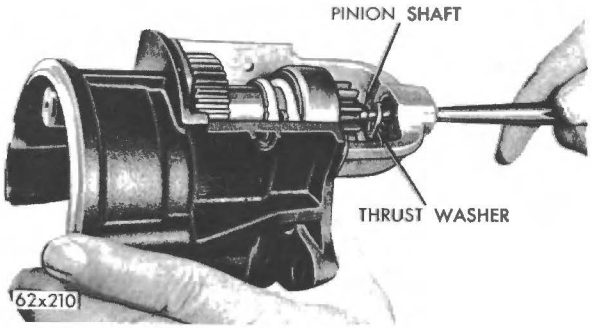


Fig. 16 Removing Pinion Shaft

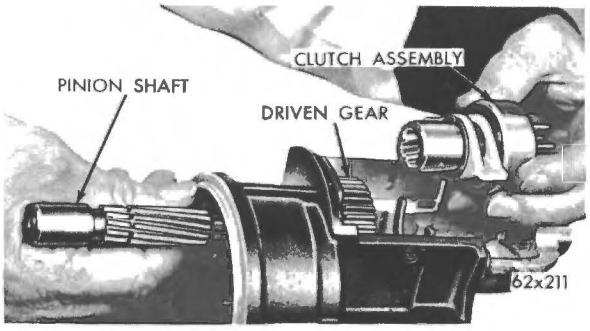


Fig. 17 Removing Clutch Assembly

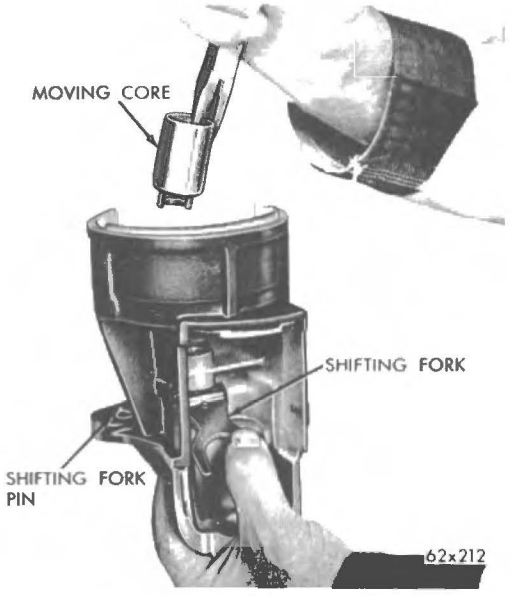


Fig. 18 Removing Moving Core

(24) Remove the shifting fork retainer pin (See Fig. 19) and remove the clutch shifting fork assembly.

(25) The gear housing is serviced with the pinion shaft and armature shaft bushings as an assembly.

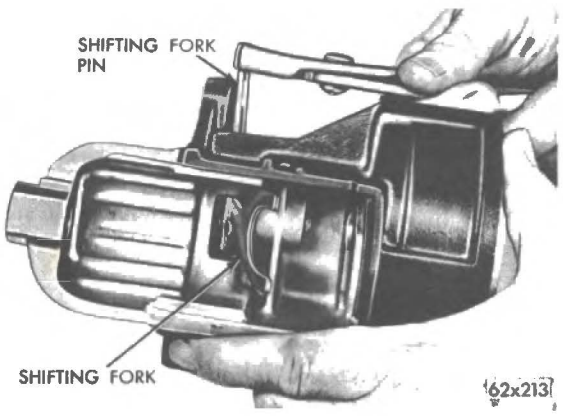


Fig. 19 Removing Shifting Fork Pin

6. CLEANING THE STARTER PARTS

(1) Do not immerse the parts in cleaning solvent. Immersing the field frame and coil assembly and/or armature will damage the insulation. Wipe these parts only with a clean cloth.

(2) Do not immerse the clutch unit in cleaning solvent. The clutch is prelubricated at the factory and solvent will wash the lubricant from the clutch.

(3) The starter clutch outer housing and pinion gear may be cleaned with a cloth moistened with cleaning solvent and wiped dry with a clean dry cloth.

7. REPLACEMENT OF BRUSHES AND SPRINGS

(1) Brushes that are worn more than half the length of new brushes, or are oil-soaked, should be replaced.

(2) When re-soldering the shunt field and solenoid lead, make a strong, low resistance connection, using a high temperature solder and resin flux. Do not use acid or acid core solder. Do not break the shunt field wire when removing and installing the brushes.

(3) Measure the brush spring tension with a spring scale hooked under the spring near the end. Pull the scale on a line parallel to the edge of the brush and take a reading just as the spring end leaves the brush. Spring tension should be 32 to 36 ozs. Replace springs that do not meet specifications.

8. ARMATURE TESTS

To Test for Short Circuit.

Place the armature in growler and hold a thin steel blade parallel to the core and just above it, while slowly rotating the armature in the growler. A shorted armature will cause the blade to vibrate and be attracted to the core. Replace any armature that is shorted.

To Test for Ground

Contact the armature shaft and each of the commutator riser bars with a pair of test lamp prods. If the lamp lights, it indicates a grounded armature. Replace any grounded armature.

To Test Commutator Run-out

Place the armature in pair of V blocks and measure the run-out with dial indicator. Measure both the shaft and commutator. A bent shaft requires replacement of the armature. When the commutator runout exceeds .003", the commutator should be refaced and undercut. Remove only sufficient metal to provide a smooth, even surface.

To Test Field Coils for Ground

(1) Remove the field frame assembly from the starter.

(2) Carefully drill out the rivet that attaches the series field coil ground lead and shunt field coil lead to the field frame.

(3) Insulate the field coil leads from the field frame.

(4) Test for ground using a 240 volt test lamp. Touch one probe of test lamp to series field coil lead and other probe to

field frame. Lamp should not light. Repeat procedure for shunt field coil. If lamp lamp, it indicates that field coils are grounded and require replacement.

9. REPLACEMENT OF FIELD COILS

A pole shoe impact screwdriver should be used to remove and install field coils to prevent damage to pole shoe screws and for proper tightening. Pole shoes that are loose or not properly seated may cause armature core to rub pole shoes. This will decrease starter efficiency and damage the armature core.

NOTE: Make sure the area between leads and starter frame is clean. Peen new rivet securely to ensure a good electrical contact.

10. SERVICING THE BUSHINGS

Inspect the armature shaft bearings and pinion shaft surfaces and bushings for wear. Try the bushings for wear by placing them on shafts and testing for side play. Replace the commutator end head and bushing assembly if bushing is worn. Replace the starter gear housing if the bushings are worn.

11. SERVICING THE STARTER CLUTCH UNIT

Do not immerse starter clutch unit in cleaning solvent. The starter clutch is pre-lubricated at the factory and solvent will wash the lubricant from clutch.

The starter clutch outer housing and pinion gear may be cleaned with a cloth moistened with cleaning solvent and wiped dry with a clean dry cloth.

Rotate the pinion. The pinion gear should rotate smoothly in one direction (not necessarily easily), but should not rotate in the opposite direction. If the starter clutch unit does not function properly, or the pinion is worn, chipped or burred, replace the starter clutch unit.

12. ASSEMBLY

The shifter fork consists of two spring steel plates assembled with two rivets(See Fig. 20). There should be approximately 1/16" side movement (See Fig. 20) to ensure proper pinion gear engagement. Lubricate between the plates sparingly with SAE 10 engine oil.

(1) Position the shifter fork in the drive housing and install the shifting fork retainer pin (See Fig. 19). One tip of pin should be straight, the other tip should be bent at a 15° angle away from the housing. Fork and retainer pin should operate freely after bending the tip of pin.

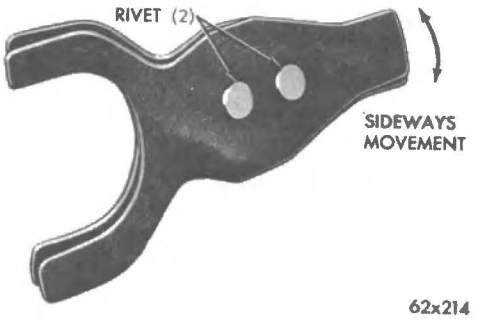


Fig. 20 Shifter Fork Assembly

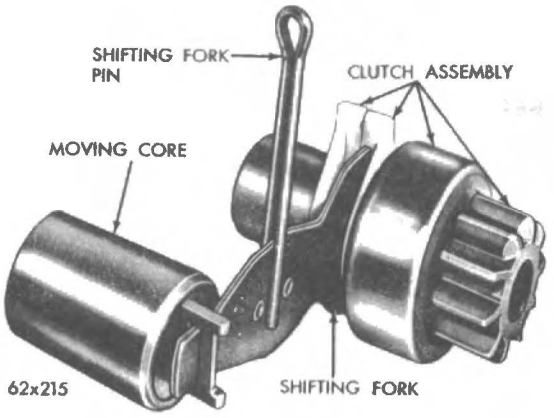


Fig. 21 Shifter Fork and Clutch Arrangement

(2) Install the solenoid moving core and engage the shifting fork (See Fig. 18).

(3) Enter the pinion shaft into the drive housing, and install the friction washer and drive gear.

(4) Install the clutch and pinion assembly (See Fig. 17), thrust washer, retaining ring and thrust washer.

(5) Complete the installation of the pinion shaft engaging the shifting fork with the clutch actuators (See Fig. 21).

NOTE: The friction washer must be positioned on the shoulder of the splines of the pinion shaft before the driven gear is positioned.

(6) Install the driven gear snap ring (See Fig. 15).

(7) Install the pinion shaft retaining ring (See Fig. 15). Make sure the ring fits tightly in the shaft groove.

(8) Install the solenoid coil retainer (See Fig. 12). (with tangs down).

NOTE: Space the retainer in the housing bore so that the four tangs rest on the ridge in the housing bore and not in the recesses.

(9) Install the solenoid coil retainer washer.

(10) Install the starter solenoid return spring (See Fig. 7).

NOTE: Inspect the condition of the starter solenoid switch contacting washer, if the top of washer is burned from arcing, disassemble the contact switch assembly and reverse the washer.

(11) Install the solenoid contact assembly into the solenoid (See Fig. 10). Make sure the contact spring is positioned on the solenoid contact assembly.

NOTE: Check condition of the contacts in the brush holder plate. If the contacts are badly burned, replace the brush holder with brushes and contacts as an assembly.

(12) Enter the solenoid lead wire through the hole in the brush holder (See Fig. 9) and solenoid stud, insulating washer, flat washer and nut.

(13) Solder the solenoid lead wire to the solenoid contact terminal (See Fig. 8). Wrap the wire securely around the terminal and solder securely with a high temperature solder and resin flux.

(14) Carefully enter the solenoid coil and solenoid coil sleeve into the bore of the gear housing and position the brush plate assembly into the starter gear housing (See Fig. 22). Align the tongue of the ground terminal with the notch in the brush holder.

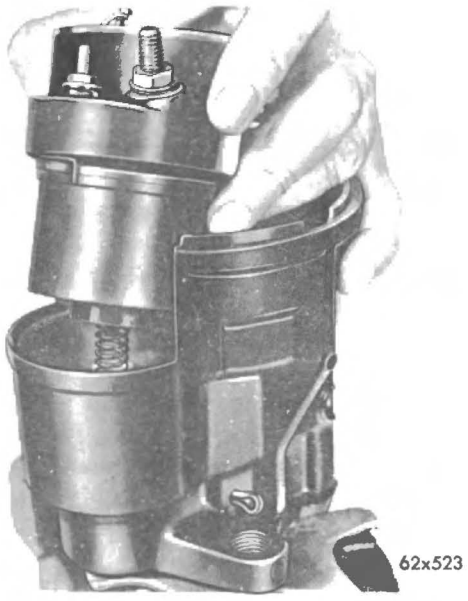


Fig. 22 Installing Solenoid Coil, Sleeve and Brush Holder

(15) After the brush holder is bottomed in the housing, install attaching screw (See Fig. 6). Tighten the screw to 10-15 lbs/in. Install the flat insulating washer and hold in place with friction tape.

(16) Position the brushes.

(17) Position the field frame to exact position and resolder the field coil lead (See Fig. 5).

(18) Install the brush terminal screw (See Fig. 4).

(19) Install the armature thrust washer on the brush holder plate (See Fig. 3) and enter the armature into the field frame and starter gear housing, carefully engaging the splines of the shaft with the reduction gear.

(20) Install the thrust washer (fibre) and washer (steel) on the armature shaft.

(21) Position the starter end head assembly and install starter frame lockwashers and screws. Tighten screws securely.

(22) Install the starter gear housing dust cover. Make sure the dimples on the cover are securely engaged in the holes provided in the gear housing.

PART 3 — ALTERNATORS AND VOLTAGE REGULATORS

SERVICE DIAGNOSIS — CONDITIONS — POSSIBLE CAUSES

1. ALTERNATOR FAILS TO CHARGE (No output)

(1) Blown fusible wire in voltage regulator. (Chrysler only).

(2) Alternator drive belt loose.

(3) Worn brushes or slip rings.

(4) Sticking brushes.

(5) Open field circuit.

(6) Open charging circuit.

(7) Open circuit in stator windings.

(8) Open rectifiers.

2. LOW, UNSTEADY CHARGING RATE

(1) Alternator drive belt loose.

(2) High tension resistance at battery terminals.

(3) High resistance in the charging circuit.

(4) High resistance in the body to engine ground lead.

(5) Open stator windings.

3. LOW OUTPUT AND A LOW BATTERY

(1) High resistance in the charging circuit.

(2) Low regulator setting.

(3) Shorted rectifier: open rectifier.

(4) Grounded stator windings.

4. EXCESSIVE CHARGING RATE TO A FULLY CHARGED BATTERY

(1) Regulator set too high.

(2) Regulator contacts stuck.

(3) Regulator voltage winding open.

(4) Regulator base not properly grounded.

5. REGULATOR CONTACTS OXIDISED

(1) High regulator setting.

(2) Regulator air gap incorrectly set.

(3) Shorted rotor field coil windings.

6. REGULATOR CONTACTS BURNED

(1) High regulator setting.

(2) Shorted rotor field coil.

7. REGULATOR VOLTAGE COIL WINDING BURNED

(1) High regulator setting.

8. REGULATOR CONTACT POINTS STUCK

(1) Poor ground connection between the alternator and the regulator.

9. NOISY ALTERNATOR

(1) Alternator mounting loose.

(2) Worn or frayed drive belt.

(3) Worn bearings.

(4) Interference between rotor fan and stator leads or rectifier.(Chrysler only).

(5) Rotor or rotor fan damaged.

(6) Open or shorted rectifier.

(7) Open or shorted winding in the stator.

10. EXCESSIVE AMMETER FLUCTUATION

(1) High resistance in the field circuit to the alternator, or an incorrectly set voltage regulator.

CHRYSLER ALTERNATOR AND VOLTAGE REGULATOR

SPECIFICATIONS

ALTERNATOR

Rated Output	30 amps
Voltage	12 volts
Alternator pulley diameter	2.75"
Brushes	2
Condenser capacity	.5 microfarads ± 20%
Field coil draw	2.38 to 2.75 amps maximum when rotating rotor by hand at 12 volts.
Current output	26 amps ± 3 amps @ 15 volts and 1250 engine RPM

VOLTAGE REGULATOR

Regulator number	2098300
Volts	12
Ground polarity	Negative
Point gap	.014" + .002"
Air gap	.048" to .052"

SPECIAL TOOLS

C-744 ...	Test lamp
C-828 ...	Voltage regulator tool kit (insulate the bending tool)
CA-3615 ...	Remover - pulley and drive end housing bearing
CA-3769 ...	Installer - drive end housing
CA-3770 ...	Remover - rectifier end housing bearing
CA-3771 ...	Support and driver - alternator diode removing
CA-3772 ...	Driver and support - alternator diode installing
CA-3829 ...	Alternator diode tester
CA-3900 ...	Slip ring installing tool
CA-3921 ...	Installer - rectifier end shield bearing grease retainer

SERVICE INFORMATION — PROCEDURES

I. DESCRIPTION

The alternator (Fig. 1) is fundamentally an A. C. current generator, with six built in silicon rectifiers that convert the A. C. current into D. C. current. D. C. current is available at the output "Bat" terminal. A voltage regulator (Fig. 3) is used in the field circuit to limit the output voltage. The main components of the alternator are the rotor, the stator, the rectifiers, the two end shields and the drive pulley (Fig. 2).

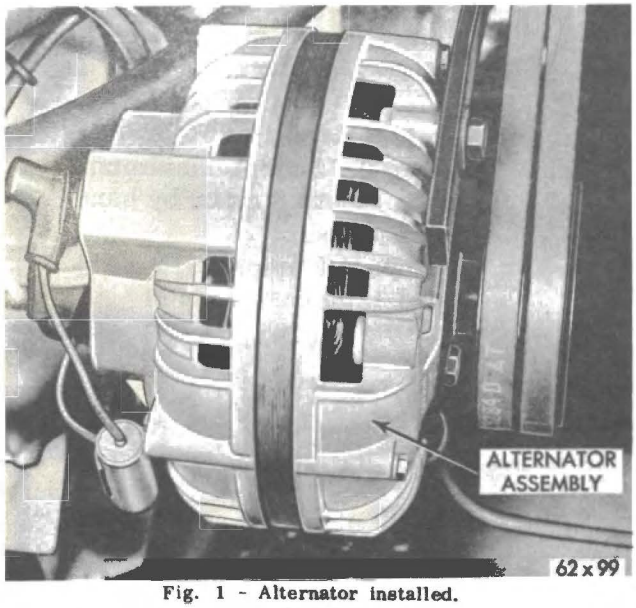


Fig. 1 - Alternator installed.

Rotor

The rotor or field (Fig. 4) consists of a circular field coil, encased by two end pole pieces, each having six protruding fingers spaced 60° apart. In assembly the six protruding fingers (of each end pole piece) are alternately spaced providing twelve poles. Since the end pole pieces have different polarity, this in effect provides a twelve pole rotating electro magnet.

The ends of the field coil winding are connected to the slip rings at the rear end of the rotor.

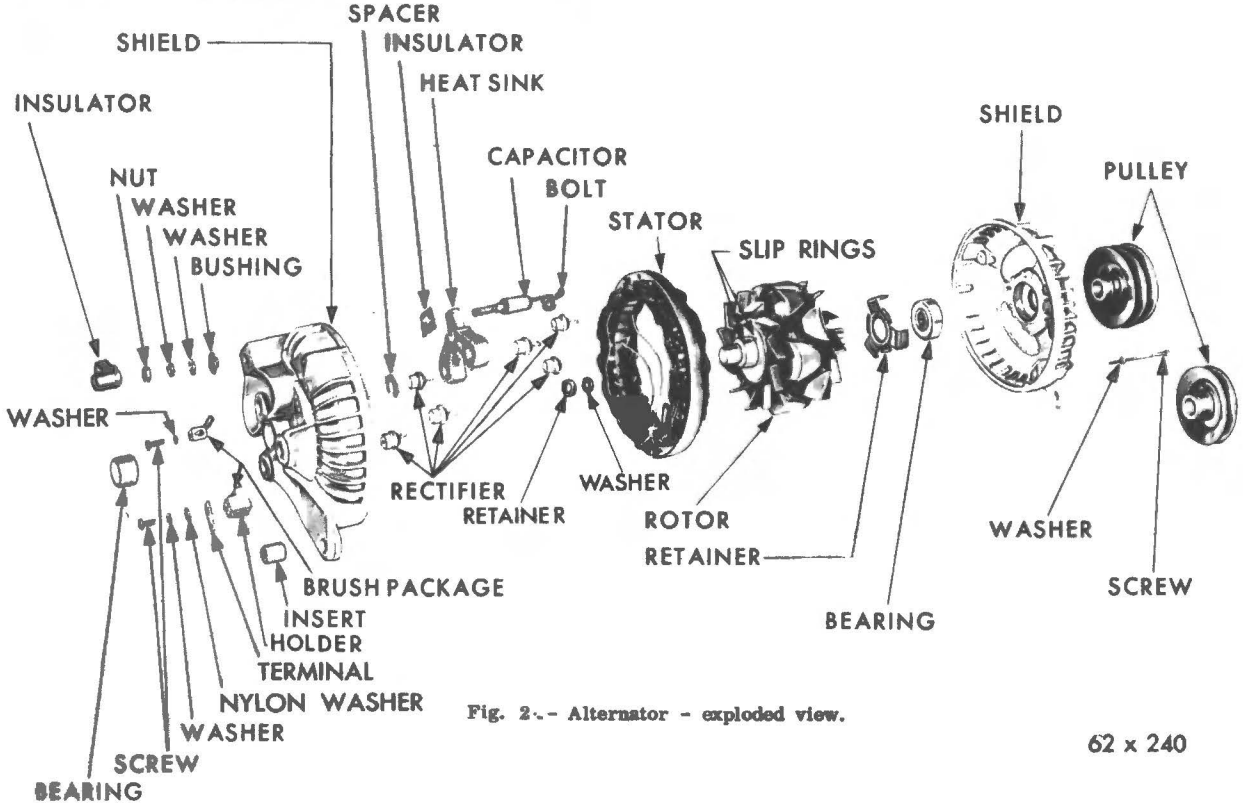


Fig. 2 - Alternator - exploded view.

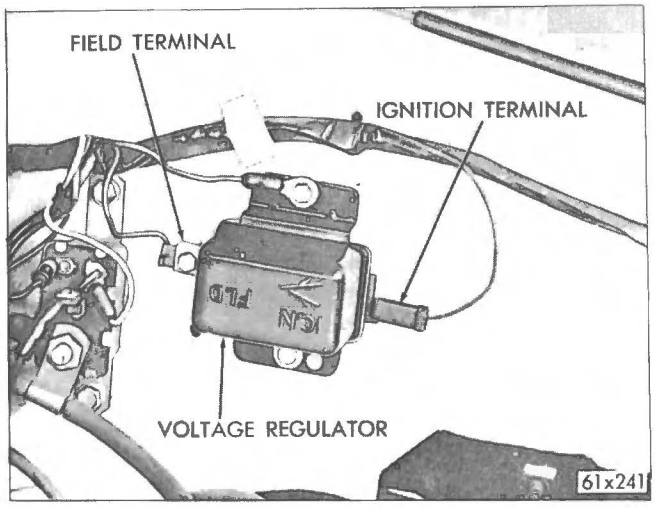


Fig. 3 - Voltage regulator.

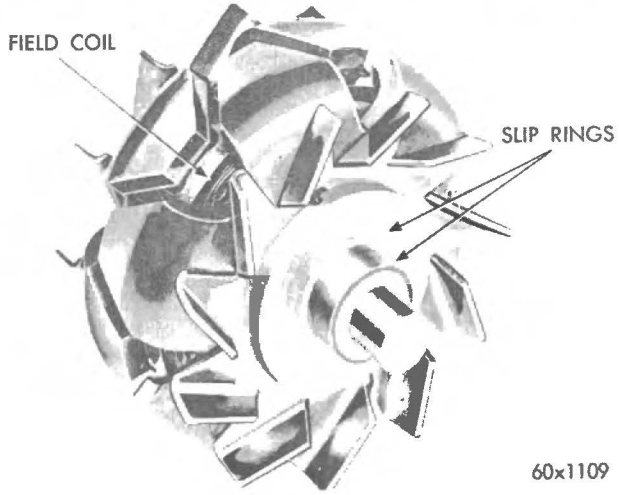


Fig. 4 - Alternator rotor assembly.

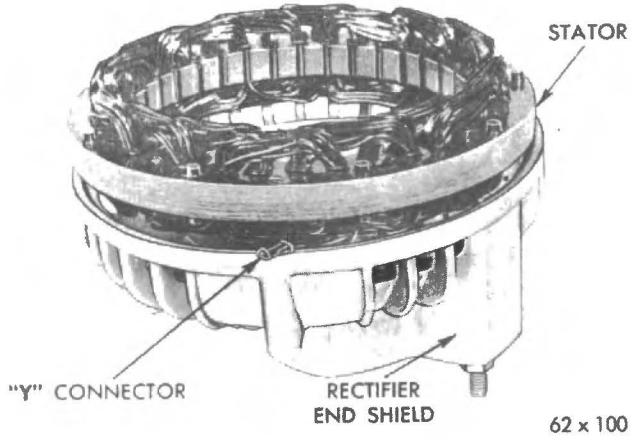


Fig. 5 - Separating stator and end shield to expose "Y" connector.

The field coil is externally excited by means of battery current. The battery current is supplied to the field coil winding through the ignition switch, the voltage regulator, the brushes and the slip rings.

Stator

The stator or armature (Fig. 5) consists of an internally slotted laminated stationary armature, having three separate sets of windings. One end of each of the windings is connected to a common "Y" connection. The other end of each winding is connected to two rectifiers.

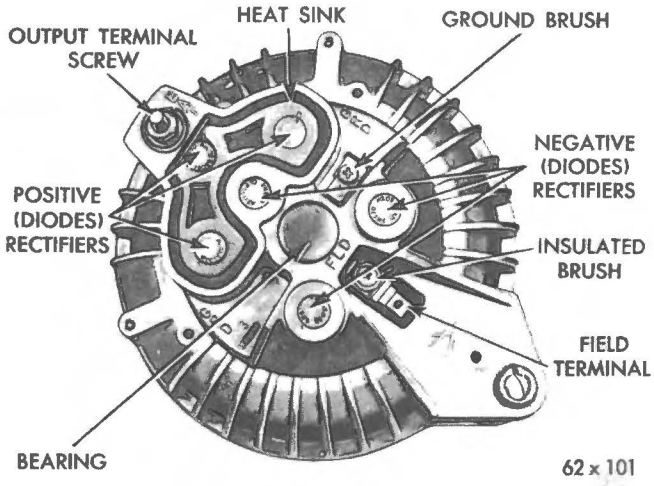


Fig. 6 - Alternator assembly.

Rectifiers

In order to convert the induced A. C. current in the stator windings into usable D. C. current, six silicon (diode) rectifiers are used (Figs. 6 and 9). Three of the rectifiers have positive polarity cases, and are pressed into an insulated die cast aluminium holder called a "heat sink". The heat sink is electrically insulated and is large enough to absorb the heat from the positive case rectifiers. The heat sink contains the "out-put" "Bat" terminal.

Three of the rectifiers have "negative" polarity cases, and are pressed into the rear die cast aluminium end shield, providing a ground in the circuit.

The silicon rectifiers have a very high resistance to current flow in one direction, and very low resistance in the opposite direction. One end of each of the three stator windings is connected to the lead of a positive case rectifier and to the lead

wire of a negative case rectifier. The other end of the three stator windings is connected together in a "Y" connection (Fig. 5).

The rectifiers permit the induced A. C. current of the three stator windings to flow in only one direction to the output "Bat" terminal. In effect this provides D. C. current at the output terminal. Since the rectifiers will permit the current to flow only in one direction, through the output terminal to the battery, and their high resistance in the opposite direction prevents the flow of battery current to the alternator, their use eliminates the need of circuit breaker (cut-out relay). For this reason the battery must always be connected with the negative terminal to ground.

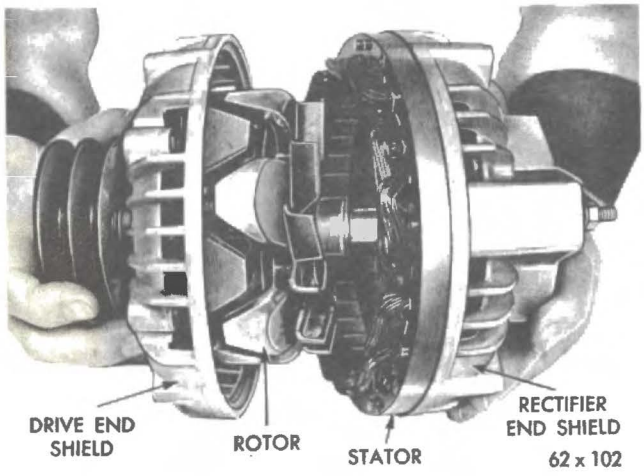


Fig. 7 - Separating drive end and rectifier shields.

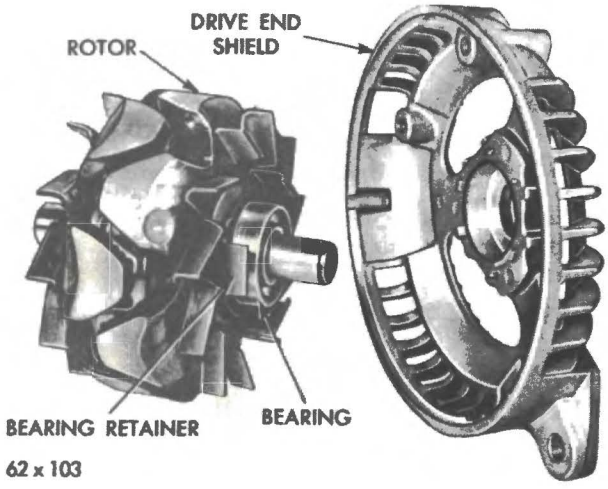


Fig. 8 - Separating rotor and bearing from drive end shield.

End Housings

The two die cast aluminium end shields (Fig. 7) support and contain the internal parts. The housings are vented at both ends and around the circumference. Two centrifugal fans on the rotor shaft force cool air through the alternator. The rotor shaft is supported on the front end by a pre-lubricated ball bearing (Fig. 8). The rear end of the rotor shaft is supported by a pre-lubricated roller bearing (Fig. 9).

Pulley

A pulley, pressed on the front end of the rotor shaft drives the rotor.

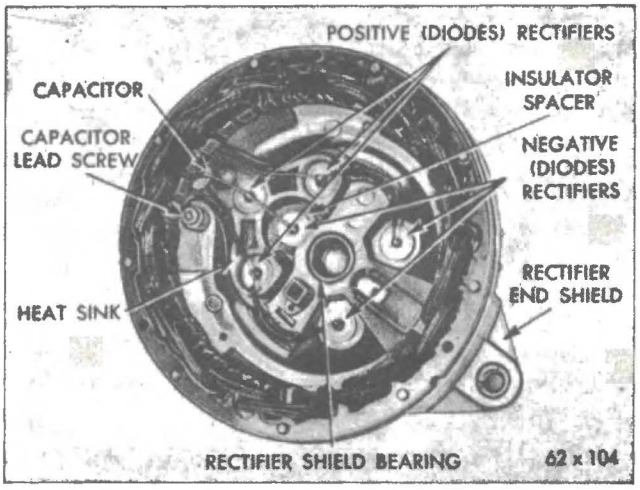


Fig. 9 - Stator and rectifier end shield assembly.

2. OPERATION

With the ignition switch turned on, and the engine running, the flow of current through the rotor field coil winding energises a twelve pole rotating electro magnet. The rotation of the rotor will cause the stator windings to cut the magnetic lines of force of the rotor. This induces an A. C. current voltage in the stator windings. The silicon rectifiers convert the (A. C.) alternating current to (D. C.) direct current at the output terminal, to carry the electrical load and charge the battery.

The silicon rectifiers prevent the battery from discharging through the alternator.

As the rotor speed increases, the induced voltage in the stator windings increases causing more current to flow to satisfy the load requirements. However, there is another factor, commonly known as "inductive reactance" which has an important bearing on current control.

"Inductive reactance" is a counter voltage (voltage of opposite polarity) which is also induced in the stator windings. The voltage tends to oppose the "induced" voltage in the stator windings.

As the rotor speed increases, the counter voltage also increases. This factor has been taken into consideration by Chrysler Engineers, and the Chrysler Alternator was designed to take advantage of this factor. By designing the correct size and shape of rotor and stator, the selection of the correct size and number of windings, the correct air gap between the rotor poles and stator, and other design features, the Chrysler Alternator permits " inductive reactance" to limit output current, therefore, no current regulator is needed.

3. VOLTAGE REGULATOR

The only function of the regulator is to limit the output voltage. The voltage regulator accomplishes this by controlling the flow of current in the rotor field coil, and in effect, controls the strength of the rotor magnetic field.

The voltage regulator (Fig. 10) is connected in the field circuit between the battery and the field terminal of the alternator. One terminal of the regulator is marked "IGN" and the other is marked "FLD". The "IGN" terminal of the regulator is connected to the coil side of the ignition switch, so that the field circuit is completed only when the ignition switch is turned on.

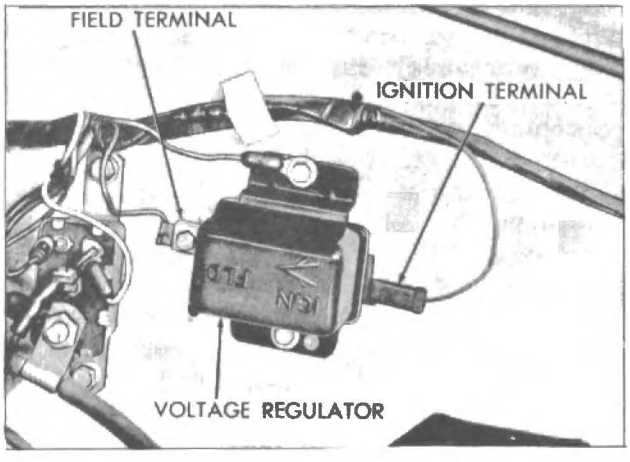


Fig. 10 - Voltage regulator terminal connections.

The voltage regulator (Fig. 11) has two sets of contacts using a common single armature. The upper and lower stationary contact brackets are mounted on a moulded plastic bracket which is attached to the regulator frame by a screw.

The upper contact bracket is connected to the "IGN" terminal by a fusible wire. The lower contact bracket is connected to ground by another fusible wire. The armature is connected to the insulated "FLD" terminal.

Three resistance units are used (Fig.12). Resistor number one and number two are connected between the "IGN" and "FLD" terminals in parallel with the upper set of contacts.

Resistor number three is connected between the "FLD" terminal and ground. Its function is to reduce arcing at the regulator contacts.

A voltage coil, consisting of many turns of fine wire, is connected in series between the "IGN" terminal of the regulator and ground. Thus, when the ignition switch is turned on, battery voltage applied to the windings energises the coil and the magnetic force of the coil tends to attract the regulator armature.

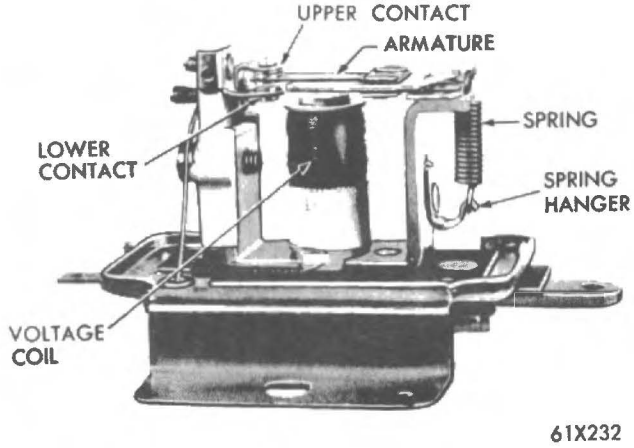


Fig. 11 - Voltage regulator (cover removed).

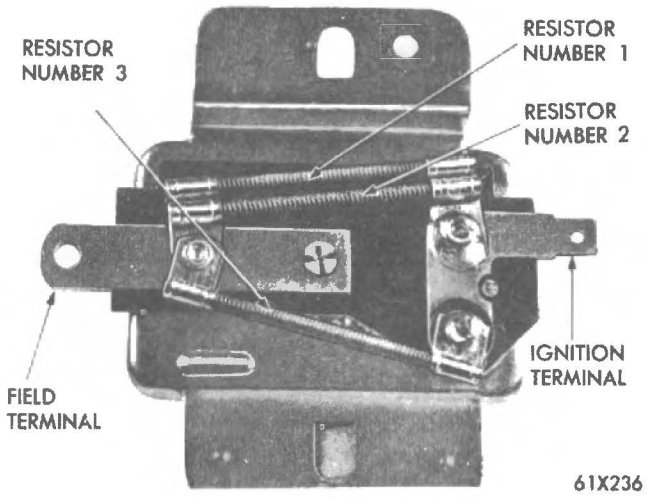


Fig. 12 - Voltage regulator resistance units.

Regulator Operation

(1) When the battery line voltage is relatively low, the current flow through the voltage coil will be low. The magnetic force (or pull) of the voltage coil will not be great enough to overcome the regulator armature spring tension which is holding the armature contact against the upper stationary contact (Fig. 13).

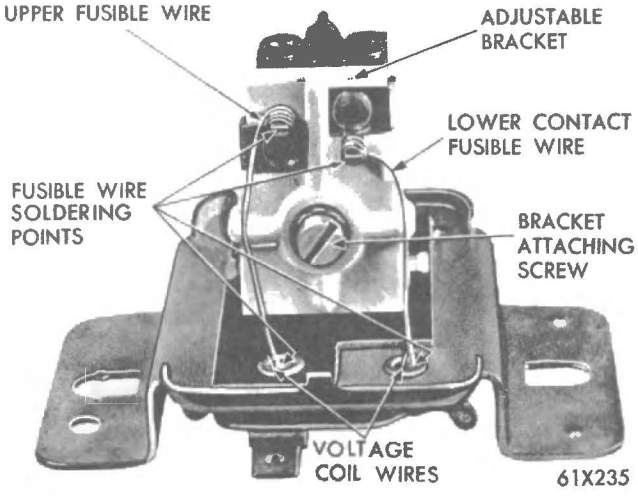


Fig. 13 - Voltage regulator fusible wires.

Battery line voltage applied to the "IGN" terminal causes current to flow through the regulator upper contacts through the "FLD" terminal of the regulator and to the insulated brush and rotor slip ring. The rotor field coil circuit is completed to ground through the other rotor slip ring and the ground brush. Inasmuch as the upper contacts are closed, the field circuit resistance is low, and maximum current will flow through the rotor field coil. The rotor field strength will be high, and the alternator output will be at its maximum for any given rotor speed.

(2) As the battery line voltage increases the magnetic pull of the voltage coil overcomes the armature spring tension and opens the upper contacts. The armature contacts at this time do not touch either the upper or lower stationary contacts. Field current now flows through the regulator "IGN" terminal, through resistance number one and two, through the "FLD" terminal, and through the rotor field to ground.

The two resistors, in series with the field circuit, reduce the field current and rotor field strength with a corresponding reduction in alternator output. This momentarily reduces battery line voltage applied to the regulator voltage coil. The regulator armature spring tension overcomes the magnetic pull of the voltage coil, closing the upper contacts. When the electrical load requirements are relatively high, the regulator armature oscillates, opening and closing the upper contacts. This alternately "puts in" and "takes out" resistance in the field circuit, and in effect limits the alternator output voltage.

(3) When the electrical load requirements are low and the engine speed is high, the alternator output voltage tends to increase. The battery line voltage (now slightly increased) causes the regulator voltage coil magnetic force to pull the armature contact against the regulator lower stationary contact. Field current flow is now through the regulator "IGN" terminal resistors number one and number two, to the regulator "FLD" terminal. Since the regulator armature is connected to the "FLD" terminal, and the lower contacts are closed, resistance is through the regulator armature to the movable contact and thence through the lower contact to ground. This is because the resistance to ground is less than the alternator rotor field coil resistance.

(4) By-passing the alternator field coil will cause the alternator output voltage and the battery line voltage to drop. This reduction in voltage will reduce the magnetic pull of the regulator voltage coil to the extent that it cannot hold the armature contact against the stationary lower contact.

The armature moves into a "no contact" position between the upper and lower stationary contacts. This momentarily allows the field current to flow through resistors number one and number two, and through the rotor field coil to ground. At high engine speed and low electrical load operation, the armature oscillates between the "no contact" position and contact with the stationary contact, to limit the battery line voltage.

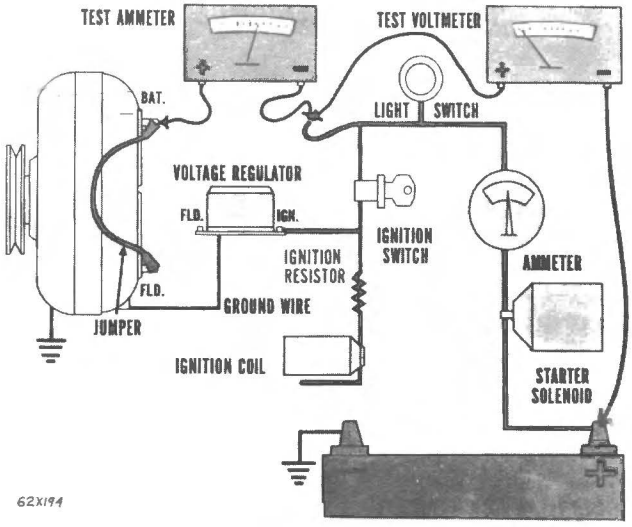


Fig. 14 - Charging circuit resistance test.

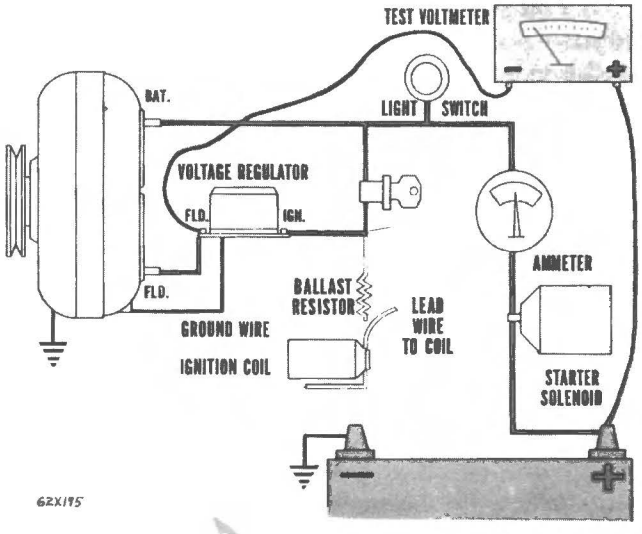


Fig. 15 - Field circuit resistance test.

4. TESTING THE ALTERNATOR SYSTEM (On Vehicle)

Test the condition of the battery and state of charge. With the battery in good condition and fully charged proceed with the tests as follows:

(1) Disconnect the lead at the alternator "Bat" terminal. Connect a 0-50 amperes scale D. C. ammeter in series between the BAT terminal and BAT lead which was disconnected from the terminal (Fig. 14).

(2) Connect the positive lead of a test D.C. voltmeter to the BAT lead, and connect the negative voltmeter lead to the battery positive (+) terminal.

(3) Start to operate the engine at a speed to obtain 10 amperes flowing in the circuit. Observe the voltmeter reading. This should not exceed .2 volt. If a higher voltage drop is indicated, inspect, clean and tighten all connections in the charging circuit. A voltage drop test may be performed at each connection to locate the connection with excessive resistance.

(4) Disconnect the test instruments. Connect the BAT lead to the alternator BAT terminal and tighten securely.

Field Circuit Resistance Test (Fig. 15)

(1) Disconnect the ignition wire at the coil side of the ballast resistor, and connect a D. C. voltmeter between the voltage regulator FLD. (field) terminal and battery positive post.

(2) Turn the ignition switch on and turn voltmeter selector switch to the low voltage scale and read the meter. The voltage should not exceed .3 volt. A reading in excess of .3 volt indicates high resistance in the field circuit between the battery and the voltage regulator field terminal.

(3) If high resistance is indicated, move the negative voltmeter lead to each connection along the circuit toward the battery. A sudden drop in voltage indicates

a loose or corroded connection between that point and the last point tested. To test the terminals for tightness, attempt to move the terminal whilst observing the voltmeter. Any motion of the meter pointer indicates looseness.

NOTE: Resistance in the regulator wiring circuit will cause flickering headlights and fluctuations in the ammeter.

Current Output Test (Fig. 16)

(1) Disconnect the battery ground cable.

(2) Disconnect the BAT lead at the alternator output BAT terminal.

(3) Connect a 0-50 ampere scale D.C. ammeter in series between the alternator BAT terminal and the disconnected BAT lead.

(4) Connect the positive lead of a test voltmeter to the output BAT lead. Connect the negative lead of the test voltmeter to ground.

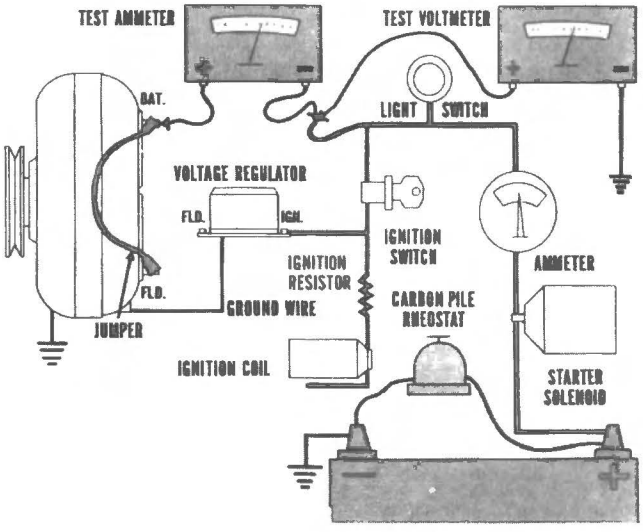


Fig. 16 - Current output test.

(5) Disconnect the field (FLD) lead at the alternator and at the regulator.

(6) Connect a jumper lead from the alternator field terminal to the alternator output BAT terminal. Be sure that the ammeter lead is satisfactorily connected to the output BAT terminal.

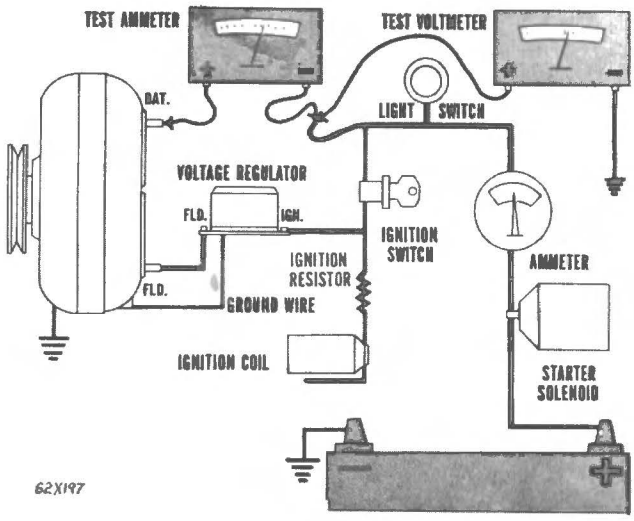


Fig. 17 - Voltage regulator test.

(7) Connect the engine tachometer. Connect the battery ground cable.

(8) Connect a battery-starter tester (equipped with a variable carbon pile) to the battery terminals.

(9) Start and operate the engine at 1250 r.p.m.

(10) Adjust the carbon pile to obtain a reading of 15 volts on the test voltmeter.

(11) Observe the reading on the test ammeter. The current output should be within the limits shown in specifications.

If the output is slightly less (5 to 7 amperes) than that shown in specifications it may be an indication of possible open rectifier or other alternator internal fault. If the output is considerably lower than that specified above, it may be an indication of a possible shorted rectifier or other alternator internal fault. In either case the alternator should be removed and tested on the bench before disassembly.

Voltage Regulator Test (On Car) (Fig. 17)

Engine at normal operating temperature.

(1) If the alternator current output tested satisfactorily; turn off the ignition switch and remove the jumper lead from the alternator field terminal and output terminal. Connect the field lead at the alternator field terminal and regulator field terminal.

The test ammeter and test voltmeter leads remain connected as for the current output test.

NOTE: If the field circuit is grounded on the field terminal side of the regulator circuit when removing or installing the lead, whilst the ignition is on, the fuse wire in the regulator circuit will be blown and the regulator may be damaged.

(2) Start and operate the engine at 1250 r.p.m. Turn on the lights and electrical accessories to obtain a 15 ampere output as registered on the test ammeter. Operate the engine at this speed and load for 15 minutes to make sure the entire regulator system is stabilised.

(3) Measure the temperature at the regulator by holding a reliable thermometer two inches from the regulator.

(4) Turn off the lights and other electrical load. Turn on the instrument panel lights. Read the test voltmeter. With a fully charged battery and 15 amperes flowing in the circuit the voltmeter reading should be within the specifications shown in the following chart.

Regulator Operating Voltage Chart

Temp. °F	47°	75°	95°	118°	140°	163°
Volts (Min.)	13.8	13.7	13.6	13.5	13.4	13.3
(Max.)	14.4	14.3	14.2	14.1	14.0	13.9

If the regulator operates within specifications, armature spring tension is correctly adjusted. If voltage is not within specifications, the trouble could be voltage regulator armature spring tension, air gap or contact point spacing - See "Regulator Mechanical Adjustments."

NOTE: No current reading on test ammeter would indicate a blown fuse wire inside the voltage regulator between the upper stationary contact and the "IGN" terminal. Correct the cause and replace the fusible wire.

(5) Increase engine speed to 2200 r.p.m. Turn off all lights and/or accessories. Voltage should increase and amperage should decrease.

NOTE: There will be a slightly higher voltage at higher engine speeds above 2200 r.p.m., however, this increased voltage must not exceed the voltage specified by more than .7 volt at any temperature range. If the voltage reading is less than .2 volt from readings in test No. 4 test the battery specific gravity to be sure battery is fully charged.

(6) If the regulator setting is outside the limits shown on the chart, the regulator must be removed to remove the cover. To adjust the voltage setting, bend the regulator lower spring hanger down to increase the voltage setting, or up to decrease voltage setting. Use an insulated tool to bend the spring hanger (Fig. 18). The regulator must be installed, correctly connected, and re-tested after each adjustment of the lower spring hanger.

NOTE: If repeated re-adjustment is required, it is permissible to use a jumper wire to ground the regulator base to the fender splash shield for testing, in lieu of re-installing the regulator each time. However it is important that the regulator cover be installed, the regulator connections correctly connected and the regulator satisfactorily insulated by the fender cover to prevent grounding the regulator terminals or resistances. When testing, the regulator must be at the same attitude (or angle) as when installed in the car.

(7) If the alternator and regulator tested satisfactorily, turn the ignition switch off. Disconnect the battery ground cable. Disconnect the test instruments. Correctly connect the leads at the alternator and the regulator. Connect the battery ground cable.

CAUTION: Be sure the negative post of the battery is always connected to ground. Incorrect battery polarity may result in wiring harness damage and may damage the alternator rectifier. Do not ground the alternator field circuit, as this may damage the regulator.

5. SERVICING THE REGULATOR

If the regulator cannot be satisfactorily adjusted for voltage control, or if the regulator performance is erratic or malfunctions, it may be necessary to adjust the regulator air gap and contact point gap.

(1) Remove the regulator from the vehicle. Remove the regulator cover.

(2) Insert a .048" wire gauge between the regulator armature and the core, next to the stop pin on the spring hanger side (see Fig. 19).

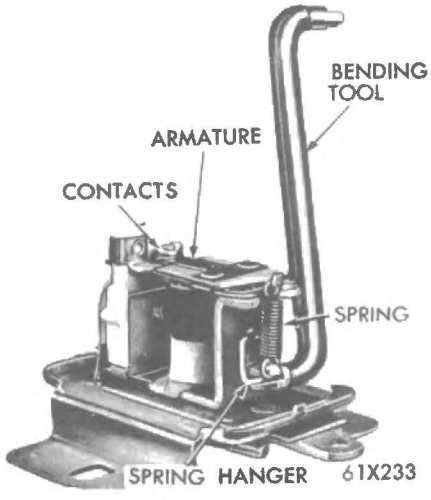


Fig. 18 - Adjusting spring tension (Tool C-828).

(3) Press down on the armature (not the contact spring) until it contacts the wire gauge. The upper contacts should just open.

NOTE: A 12 volt battery and test light connected in series to the "IGN" and "FLD" terminals may be used to accurately determine the contact opening. When the contacts open, the test light will go "dim".

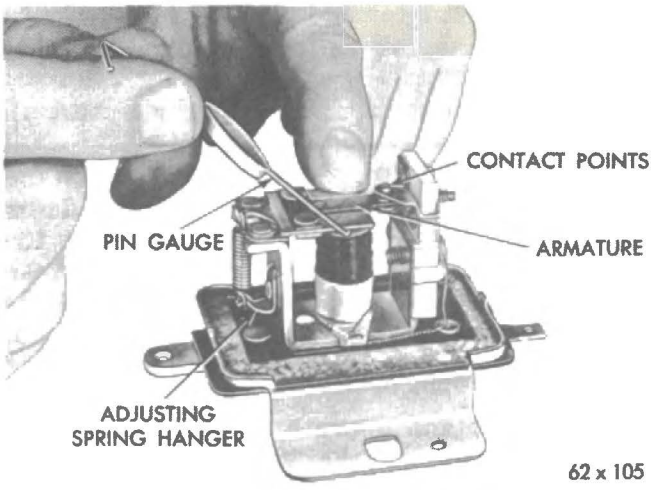


Fig. 19 - Checking air gap (Tool C-828).

(4) Insert a .052" wire gauge between the armature and the core, next to the stop pin on the spring hanger side.

(5) Press down the armature until it contacts the wire gauge. The contacts should remain closed and the test light should remain bright.

(6) If adjustment is required, adjust the air gap by loosening the screw and moving the stationary contact bracket; make sure the air gap is checked with attaching screw fully tightened. Re-measure the air gap as described in steps 2, 3, 4 and 5.

(7) Remove the wire gauge from under the armature. Measure the lower contact gap with a feeler gauge. The lower contact gap should be .015" (plus or minus .001"). Adjust the lower contact gap by bending the lower stationary contact bracket.

(8) Install the regulator cover. Install the regulator. The electrical adjustment must be performed on the car after installation of the regulator.

6. ALTERNATOR SERVICING

Removal

If the alternator performance does not meet current output specifications, it will have to be removed and disassembled for further test and servicing.

(1) Disconnect the battery ground cable.

(2) Disconnect the alternator output "BAT" and "FLD" leads and disconnect ground wire.

(3) Remove the alternator from the vehicle.

7. FIELD COIL DRAW

If the alternator field coil draw has not been tested on the vehicle, it may be tested on the test bench as follows:

(1) Connect one lead of a test ammeter to one terminal of a fully charged battery. Connect a jumper wire to the other terminal of the battery and ground it to the alternator end shield. Connect the other ammeter lead to the field terminal of the alternator.

(2) Slowly rotate the alternator rotor by hand. Observe the ammeter reading. The field coil draw should be 2.3 amperes at 12 volts.

NOTE: A low rotor coil draw is an indication of high resistance in the field coil circuit (brushes, slip rings, or rotor coil). A higher rotor coil draw indicates a possible shorted rotor coil or a grounded rotor.

8. TESTING ALTERNATOR INTERNAL FIELD CIRCUIT FOR GROUND

(1) To test the internal field circuit for a ground, remove the ground brush. Touch one test prod from a 240 volt test lamp to the alternator insulated brush terminal, and the remaining test prod to the end shield. If the rotor assembly or insulated brush is not grounded, the lamp will not light.

(2) If the lamp lights, remove the insulated brush assembly (noting how the parts are assembled) and separate the end shields by removing the three through bolts.

(3) Again test by placing one of the test prods to a slip ring and the remaining test prod to the end shield. If the lamp lights, the rotor assembly is grounded, and requires replacement. If lamp does not light after removing the insulated brush and separating the end shields, the cause of the ground was that the insulated brush is grounded.

(4) Examine the plastic insulator and the screw. The screw is a special size and must not be substituted by another size.

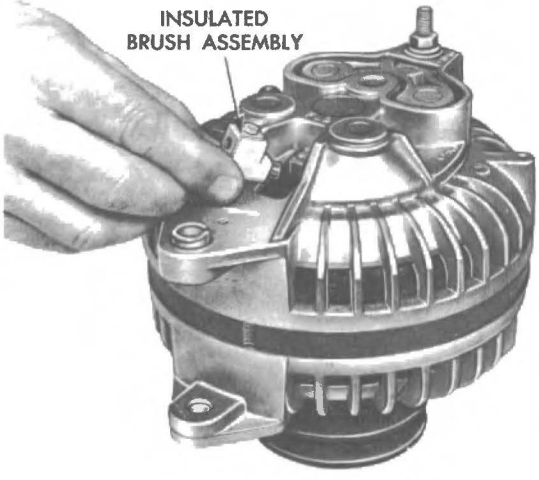
(5) Install insulated brush holder, terminal, insulated washer, shakeproof washer and screw. If the parts were not assembled in this order or if the wrong screw was used, this could be the cause of the ground condition.

9. DISASSEMBLY AND TESTS

To prevent possible damage to the brush assemblies, they should be removed before proceeding with the disassembly of the alternator. The insulated brush is mounted in a plastic holder that positions the brush vertically against one of the slip rings.

(1) Remove the retaining screw lockwasher, insulated washer and field terminal, and carefully lift plastic holder containing the spring and brush assembly from the end housing (Fig. 20).

(2) The ground brush is positioned horizontally against the remaining slip ring and is retained in a holder that is integral with the end shield. Remove the retaining screw and lift the clip, spring and brush assembly from the end shield (Fig. 21).



62 x 106

Fig. 20 - Removing or installing insulated brush.

CAUTION: Stator is laminated, do not burr stator or end shield.

(3) Remove the through bolts and pry between the stator and drive end shield with

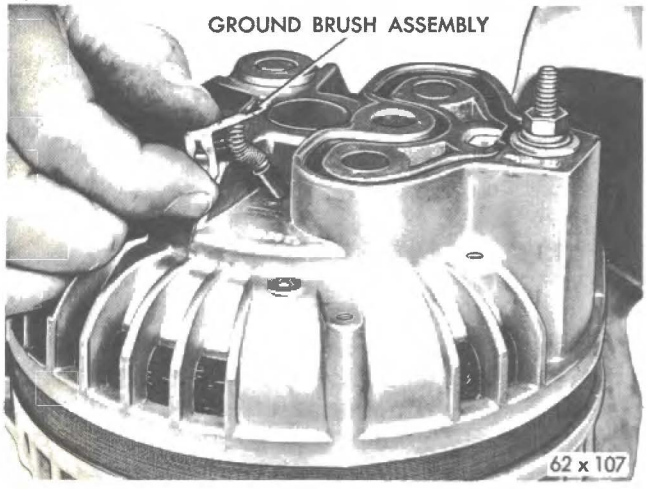


Fig. 21 - Removing or installing ground brush.

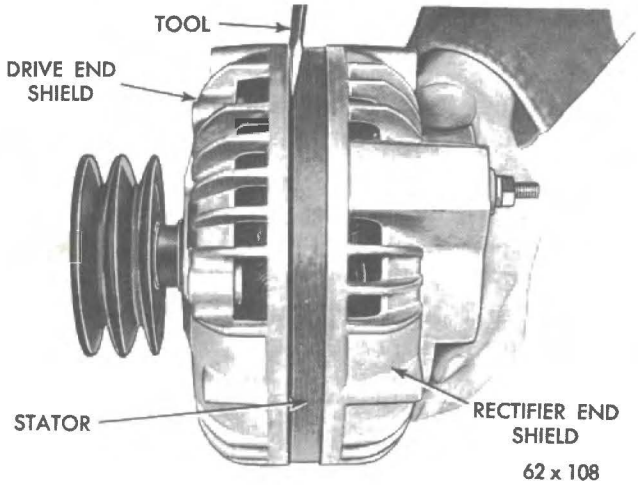


Fig. 22 - Separating drive end shield from stator.

the blade of a screwdriver (Fig. 22). Carefully separate the drive end shield, pulley and rotor assembly away from the stator and rectifier shield assembly.

Testing the Rectifiers (With Tool CA-3829)

The rectifier tester Tool CA-3829 provides a quick, simple and accurate method of testing the alternator rectifiers without the necessity of disconnecting the soldered rectifier leads.

With the alternator rectifier end shield separated from the drive end housing, proceed with the rectifier tests as follows:

Positive Case Rectifier Test (Fig. 23)

(a) Place the alternator on an insulated surface. Connect the test lead clip to the alternator "BAT" output terminal.

(b) Plug in the Tool CA-3829 power source lead into a 240 A.C. power supply. Touch the exposed bare metal connections of each of the positive case rectifiers, with a test prod.

CAUTION Do not break the sealing around the rectifier lead wire, or on the inner end of the rectifier. The sealing material is for protection against corrosion. Always touch the test prod to the exposed metal connection nearest the rectifier.

The reading for satisfactory rectifiers will be $1\frac{3}{4}$ amperes or more. The reading should be approximately the same for the three rectifiers.

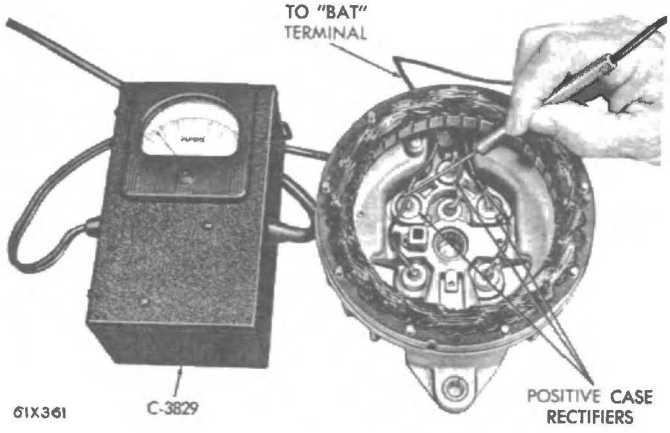


Fig. 23 - Testing positive case rectifiers (Tool CA-3829).

When two rectifiers are good and one is shorted, the reading taken at the good

rectifier will be low, and the reading taken at the shorted rectifier will be zero. Disconnect the lead to the rectifier reading zero and retest. The reading of the good rectifier will now be within the satisfactory range.

When one rectifier is open it will read approximately one ampere, and the two good rectifiers will read within the satisfactory range.

Negative Case Rectifier Test (Fig. 24)

(a) Connect the test lead clip to the rectifier end housing.

(b) Touch the exposed connection of each of the negative case rectifiers with a test prod. The test specifications are the same, and the test results will be approximately the same as for the positive case rectifiers, except the meter will read on the opposite side of the scale.

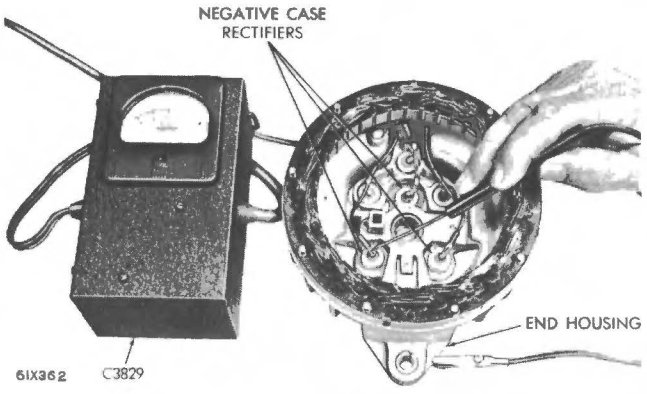


Fig. 24 - Testing negative rectifiers (Tool CA-3829).

Testing the Rectifiers and Stator (Without Tool CA-3829)

(a) Separate the three stator leads at the "Y" connection (Fig. 25).

NOTE: Cut the stator connections as close to the connection as possible, because they will have to be soldered together again. If they are cut too short it may be difficult to get them together again for soldering.

(b) Test the rectifiers with a 12 volt battery and a test lamp equipped with a four candle-power bulb, by connecting one side of test lamp to the positive battery post, the other side of the test lamp to a test probe, with the other test probe connected to the negative battery post.

(c) Contact the outer case of the rectifier with one probe and the other probe to the wire in the centre of the rectifier (Fig. 26).

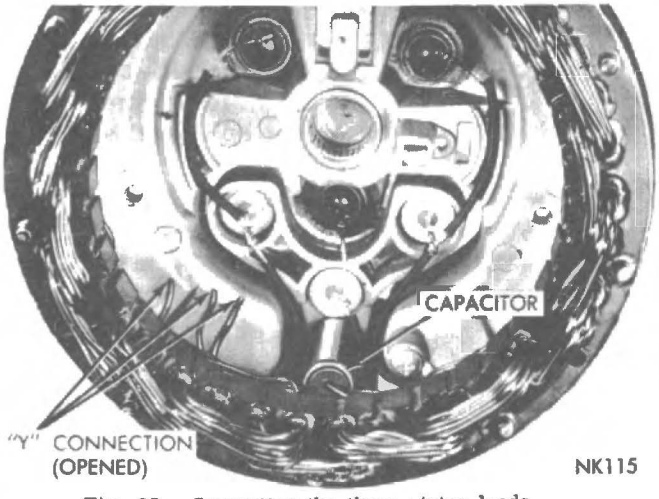


Fig. 25 - Separating the three stator leads.

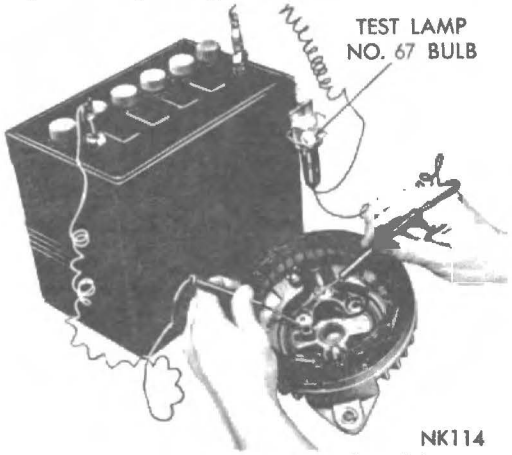


Fig. 26 - Testing rectifiers with test lamp (Tool C-744).

(d) Reverse the probes, moving the probe from the rectifier outer case to the rectifier wire, and the probe from the rectifier wire to the rectifier outer case. If the test lamp lights in one direction, but does not light in the other direction, the rectifier is satisfactory. If the lamp lights in both directions the rectifier is short circuited. If the test lamp does not light in either direction, the rectifier is open circuited.

NOTE: The usual cause of an open or a blown rectifier is a faulty capacitor or a battery that has been installed in reverse polarity. If the battery is installed correctly and the rectifiers are open, test the capacitor capacity (.5 microfarads ± 20%).

(e) Disconnect the rectifiers from the stator leads.

(f) Test the stator for grounds using a 240 volt test lamp (Fig. 27). Use wood slats to insulate the stator from the rectifier shield. Contact one prod of the test lamp to the stator pole frame, and contact the other prod to each of the three stator leads. The test lamp should not light. If the test lamp lights, the stator windings are grounded.

(g) Test the stator windings for continuity, by contacting one prod of the test lamp to all three stator leads at the "Y" connection. Contact each of the three stator leads (disconnected from the rectifier). The test lamp should light when the prod contacts each of the three leads. If the test lamp does not light, the stator winding is open (Fig. 28).

(h) Install a new stator if the one tested is "grounded" or "open". If the rectifiers must be replaced, unsolder the rectifier wire at the soldered joint.

NOTE: Three rectifiers are pressed into the heat sink, and three into the end shield. When removing the rectifiers, it is necessary to support the end shield and/or heat sink to prevent damage to these castings.

(i) Support the rectifier shield on Tool CA-3771 welded to a support plate.

NOTE: This tool is cut away and slotted to fit over the wires and around the bosses in the shield. Make sure that the bore of the tool completely surrounds the rectifier, then press the rectifier out of the shield using a suitable press out tool (Fig. 29).

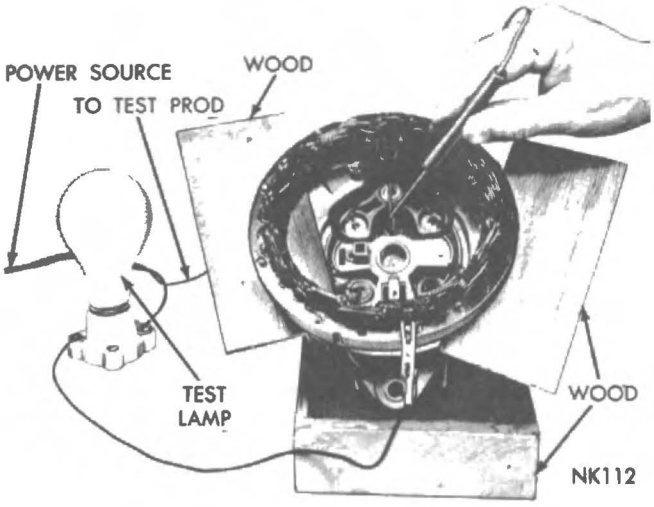


Fig. 27 - Testing stator for grounds (Tool C-744).

Fig. 28 - Testing stator windings for continuity (Tool C-744).

(4) The pulley is an interference fit on the rotor shaft. Remove the pulley with puller Tool CA-3615, and special adaptors CA-3615/1.

(5) Pry the drive end bear g spring retainer from the end shield with a screwdriver (Fig. 31).

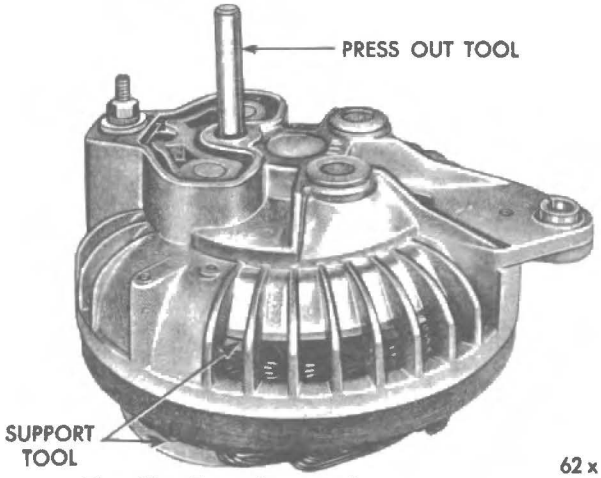


Fig. 29 - Removing rectifier (Tool CA-3771).

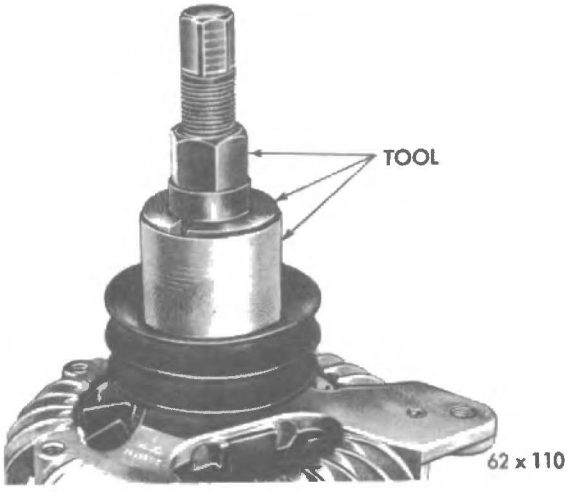


Fig. 30 - Removing pulley (Tool CA-3615) Adaptors CA-3615/1.

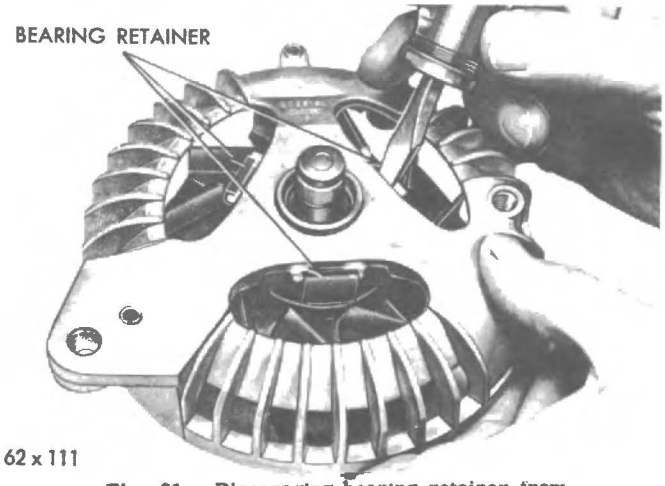


Fig. 31 - Disengaging bearing retainer from end shield.

(6) Support the end shield and tap the rotor shaft with a plastic hammer to separate the rotor from the end shield.

If the drive end bearing is to be replaced, always use the new bearing Part No. 2095653.

NOTE: The new bearing is lubricated with a pre-determined amount of special lubricant and does not require additional lubricant.

(7) The drive end ball bearing is an interference fit with the rotor shaft. Remove the bearing with puller Tool CA-3615 as follows:

(a) Position the centre screw to Tool CA-3615 on rotor shaft.

(b) Place the thin lower end of the adaptors CA-3615/2 under the bearing equally spaced, and the upper end of the adaptors around the centre screw.

(c) Hold the adaptors and centre screw in position with the tool sleeve.

CAUTION: Tool sleeve must bottom on bearing, otherwise adaptors may be damaged.

(d) Turning centre screw whilst holding the outer body of tool (Fig. 32) will withdraw the bearing from the rotor shaft.

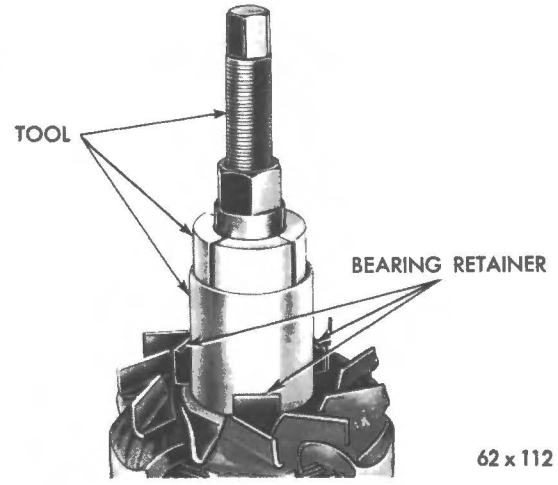


Fig. 32 - Removing bearing from rotor shaft (Tool CA-3615 and adapters CA-3615/2).

NOTE: No further disassembly of the rotor is required, as the balance of the rotor assembly is not serviced separately.

(8) Remove the D. C. output terminal nuts and washers and remove terminal screw capacitor.

NOTE: The heat sink is also held in place by the terminal screw.

(9) Remove the insulator (Fig. 33).

(10) The needle roller bearing in the rectifier end shield is a press fit. If it is necessary to remove the rectifier end frame needle bearing, protect the end shield by supporting the shield with Tool CA-3770/1 when pressing out the bearing with Tool CA-3770 (Fig. 34).

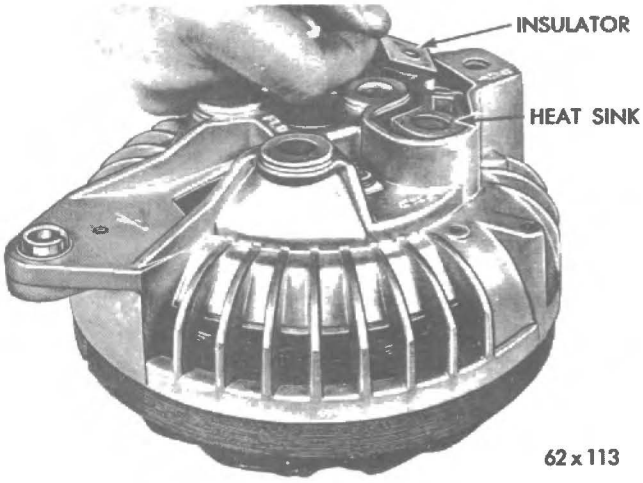


Fig. 33 - Removing or installing heat sink insulator.

NOTE: The new bearing is pre-lubricated and no additional lubricant should be added, as an excessive amount of lubricant will contaminate the slip rings and cause premature brush or rotor failure.

10. REPLACING SLIP RINGS

Slip rings that are damaged can be replaced as follows:

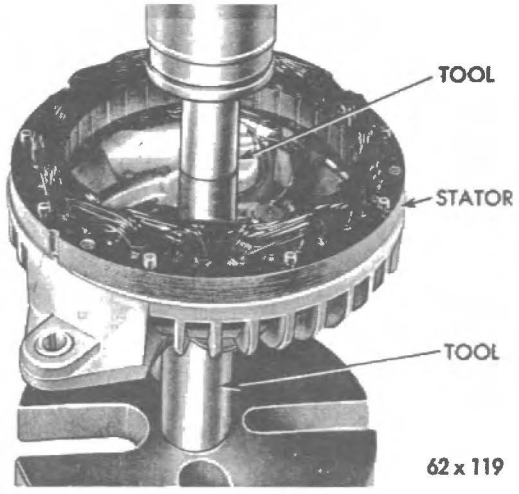


Fig. 34 - Removing rectifier end shield bearing (Tools CA-3770, CA-3770/1).

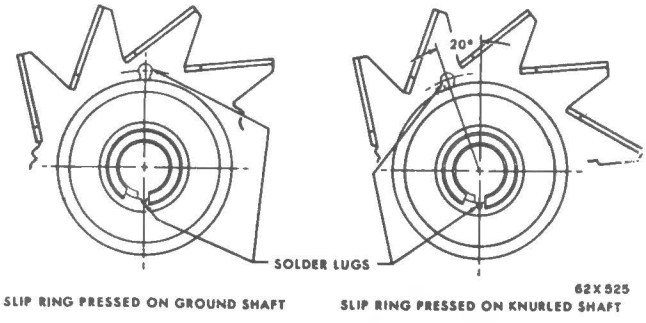


Fig. 35 - Slip ring solder lugs.

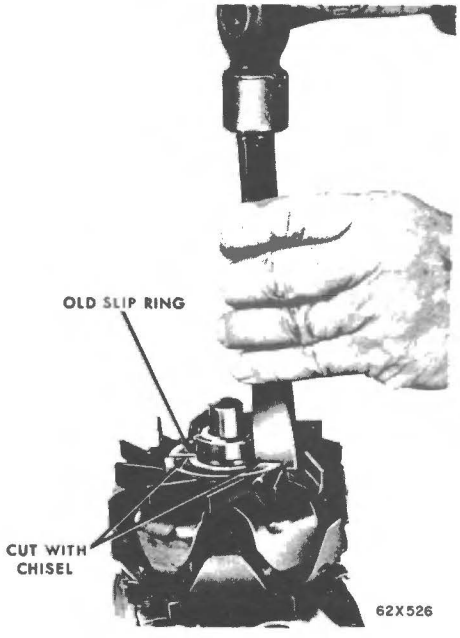


Fig. 36 - Cutting old slip rings.

(a) Cut through the rotor grease retainer with a chisel and remove the retainer and insulator.

(b) Unsolder the field coil leads at the solder lugs (Fig. 35).

(c) Cut through the copper of both rings at opposite points (180° apart) with a chisel (Fig. 36).

(d) Break the insulator and remove the old ring.

(e) Clean away dirt and particles of the old slip ring from the rotor.

(f) Scrape the ends of the field coil lead wires clean for good electrical contact.

(g) Scrape one end (about 3/16") of a piece of bare wire (approximately 18 gauge) three inches long (to be used as a guide wire).

(h) Tin the scraped area of the guide wire with resin core solder. Lap the tinned end of the wire over the field coil lead to the insulated ring and solder the two together.

(i) Position the new slip ring carefully over the guide wire and the rotor shaft so that the wire will lay in the slip ring groove (Fig. 37).

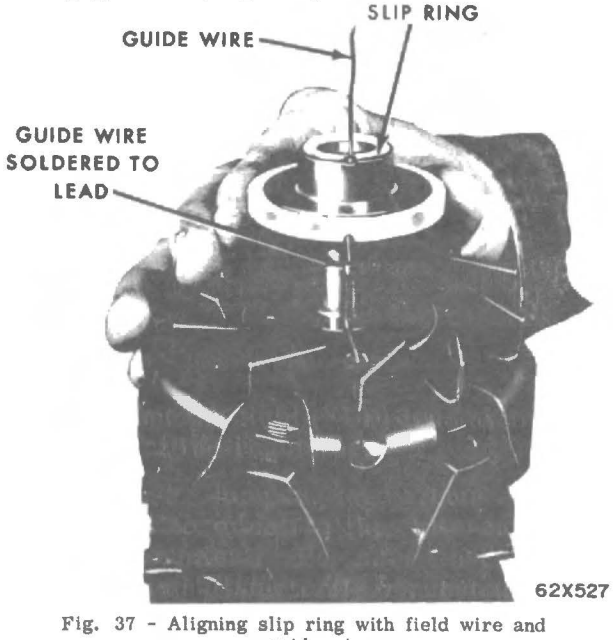


Fig. 37 - Aligning slip ring with field wire and guide wire.

The groove in the slip ring must be in line with the insulated brush field lead to provide room for the lead without damaging it.

(j) Place installing Tool CA-3900 over the rotor shaft with the guide wire protruding from the slot in the tool.

(k) Position rotor, slip ring and tool assembly in an arbor press (Fig. 38). Pull on the guide wire being careful to guide the insulated field lead into the slip groove. Whilst guiding the insulated field lead through the groove, press the slip ring on the shaft. When the slip ring is bottomed on the rotor fan, the end of the field lead should be visible at the solder lug. (Fig. 39).

(l) Unsolder the guide wire from insulated brush slip ring lead. Press the field lead into the solder lug and solder to lug with resin cored solder.

CAUTION: Do not use acid core solder. A short circuit may result, and corrosion will definitely occur. Be sure the solder bead does not protrude beyond the surface of the plastic material.

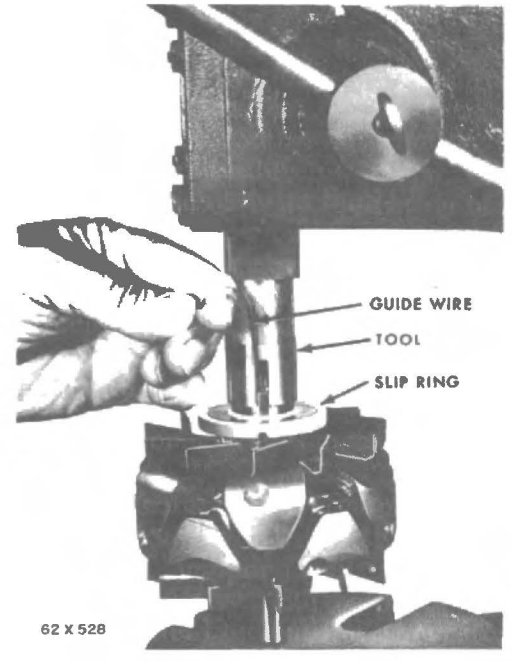


Fig. 38 - Installing slip ring (Tool CA-3900).

(m) Coil the ground brush ring field lead around the solder lug (Fig. 39) and solder with resin core solder.

(n) Test the slip rings for ground with a 240 volt test lamp by touching one test lead prod to rotor pole shoe, and remaining prod to slip rings. Test lamp

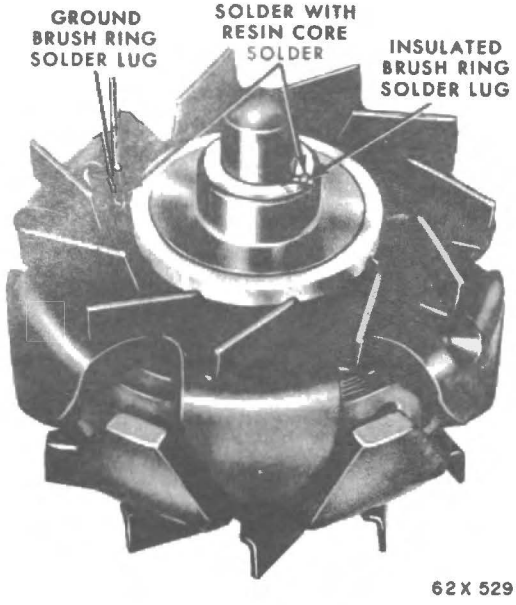


Fig. 39 - Solder points - slip ring installed.

should not light. If lamp lights, slip rings are shorted to ground, possibly due to grounding on insulated field lead when installing slip rings. If the rotor is not grounded, lightly clean the slip ring surfaces with 00- sandpaper.

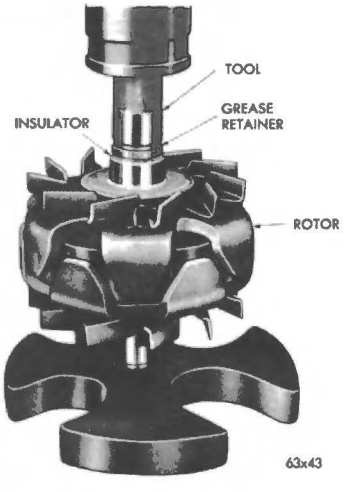


Fig. 40 - Installing grease retainer (Tool CA-3921).

(o) Position a new grease retainer insulator and grease retainer on the rotor shaft and press the retainer on the shaft using Tool CA-3921 (Fig. 40). Retainer is properly positioned when inner bore of installer tool bottoms on rotor shaft.

II. ASSEMBLY

(1) Support the heat sink or rectifier end shield on circular plate of Tool CA-3772.

NOTE: Remove the output terminal nuts before installing new rectifier.

(2) Note the rectifier identification to make sure the correct rectifier is being installed. Refer to parts list for rectifier identification.

(3) Start the new rectifier into the casting squarely and press the rectifier into the casting with Tool CA-3772 (Fig. 41).

CAUTION: The outer counterbore of the installing Tool CA-3772 must clear the outside diameter of the rectifier (diode) and the .515" inner counterbore of the tool must clear the plastic dome to ensure that all pressing force is applied on the outside rim of the rectifier. Do not use a hammer or shock the rectifier in any manner as this will fracture the thin silicon wafer in the rectifier, causing complete rectifier failure.

(4) Solder the wire lead to the wires disconnected at removal. Hold the wire lead with pliers (Fig. 42) whilst soldering it. This will help to dissipate heat, protecting the rectifier.

(5) Support the end shield on Tool CA-3770 so that the notch in support tool will clear the raised section of the heat sink and press the bearing into position with the drive Tool CA-3770 (Fig. 43).

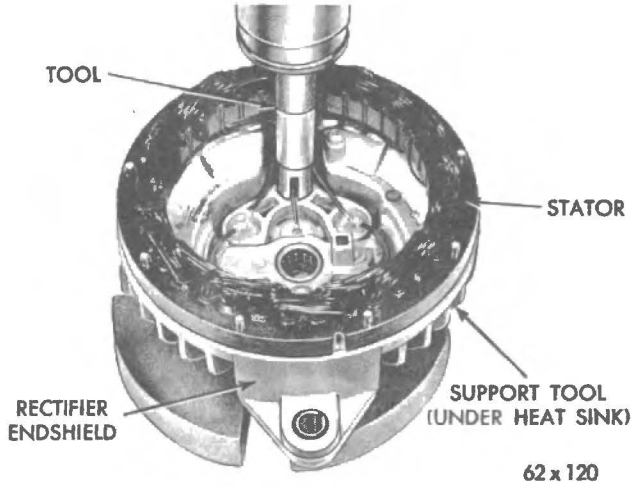


Fig. 41 - Installing a rectifier (Tool CA-3772).

NOTE: The exterior surface of the bearing must be flush with the housing surface. New bearings are pre-lubricated, additional lubrication is not required.

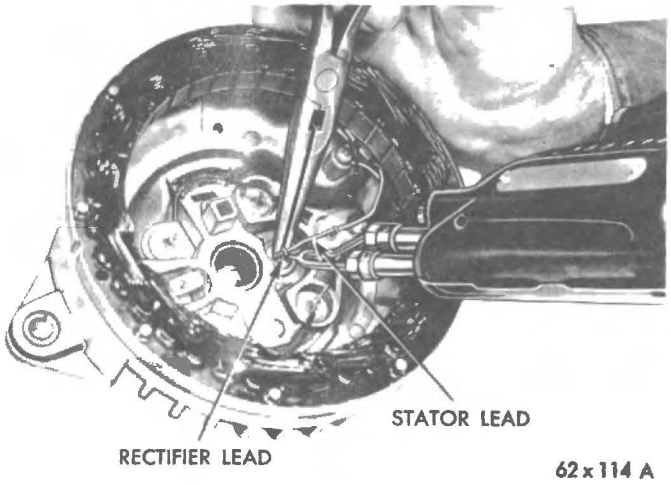


Fig. 42 - Soldering rectifier and stator leads.

(6) Insert the drive end bearing in the drive end shield with the shielded side of bearing toward the rotor and install the bearing retainer plate to hold the bearing in place.

(7) Position the bearing and drive end shield on the rotor shaft, and, whilst supporting the base of the rotor shaft, press the bearing and shield into position on the rotor shaft with arbor press and Tool CA-3769 (Fig. 44).

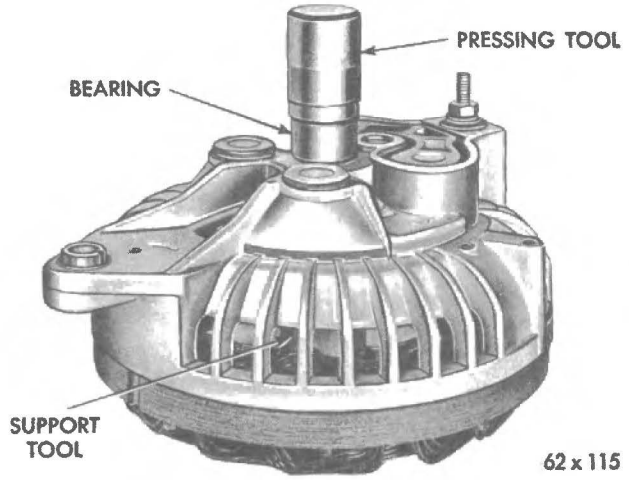


Fig. 43 - Installing rectifier end shield bearing (Tool CA-3770).

CAUTION: Make sure that the bearing is installed squarely at installation; otherwise damage to the bearing will result. Press the bearing on the rotor shaft until the bearing contacts the shoulder on the rotor shaft.

(8) Install the pulley on the rotor shaft. The shaft of the rotor must be supported in a manner so that all pressing force is on the pulley hub and rotor shaft (Fig. 45).

NOTE: Do not exceed 6800 lbs. pressure. Press pulley on the rotor shaft until the pulley contacts the inner race of the drive end bearing.

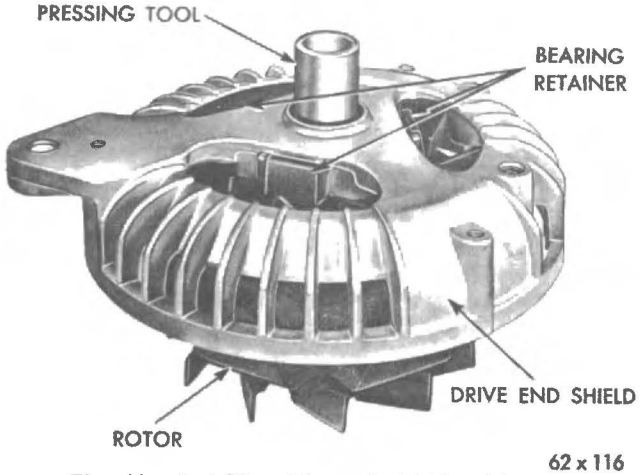


Fig. 44 - Installing drive end shield and bearing (Tool CA-3769).

(9) Alternators have the capacitor mounted internally. Make sure the heat sink insulator is in place.

(10) Install the output terminal screw with capacitor attached through the heat sink and end shield.

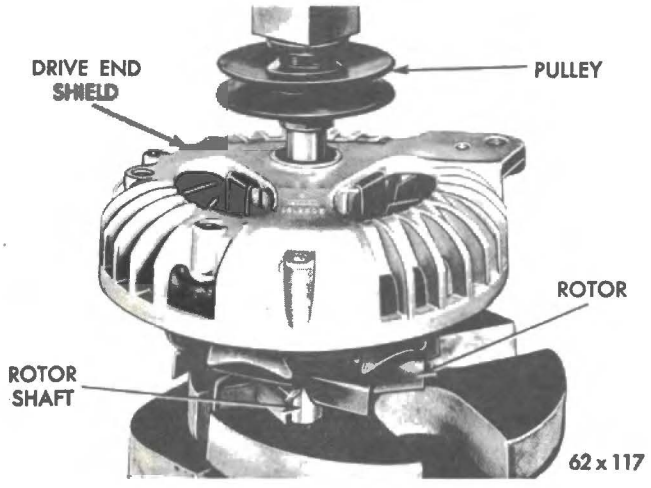


Fig. 45 - Installing alternator pulley.

(11) Install the insulating washers, lockwashers and lock nuts.

(12) Make sure the heat sink and insulator are in position and tighten the lock nut.

(13) Position the stator on the rectifier end shield.

(14) Position the rotor end shield assembly on the stator and rectifier end shield. Align the through bolt holes in the stator, rectifier end shield and drive end shield.

(15) Compress the stator and both end shields by hand and install the through bolts, washers and nuts.

(16) Install the insulated brush in the rectifier end. Place the bronze terminal on the plastic holder with the tab of the terminal in the recess in the plastic holder.

(17) Place the nylon washer on the bronze terminal and install the lockwasher and attaching screws.

(18) Install the ground brush and attaching screw.

(19) Rotate the pulley slowly by hand to be sure that the rotor fans do not strike the rectifiers capacitor lead, and the stator connectors.

(20) Install the alternator and adjust the drive belt according to the instructions in "Accessory Belt Drive" Group 7 of the Manual.

(21) Connect the output (Bat) and field (FLD) leads and connect the ground wire.

(22) Connect the battery ground cable.

(23) Start engine and operate the engine, and observe the alternator operation.

(24) Test the current output and regulator voltage setting if necessary.

EMAIL ALTERNATOR AND VOLTAGE REGULATOR

SPECIFICATIONS

ALTERNATOR:

Rated Output	38 amps
Voltage	12 volts
Alternator pulley diameter	2.75"
Brushes	2
Field coil draw	2.0 to 2.3 amps at 10 volt when rotating rotor by hand
Current output	35 amps minimum at 14.2 volts engine speed 1800 RPM

VOLTAGE REGULATOR:

Regulator number	A2595269
Voltage	12
Ground polarity	Negative
Point gap	.010" - .012"
Air gap	.029" - .037"

SPECIAL TOOLS

C-744	Test Lamp
C-828	Voltage regulator tool kit (insulate bending tool)
CA-3615	Remover-pulley and drive end housing bearing
CA-3771	Support and driver - alternator diode removing
CA-3772	Driver and support - alternator diode installing
CA-3829	Alternator diode tester

SERVICE INFORMATION — PROCEDURES

I. DESCRIPTION

The alternator (Fig. 1) is fundamentally an A. C. current generator, with six built in silicon rectifiers that convert the A. C. current into D. C. current. D. C. current is available at the output "Bat" terminal. A voltage regulator (Fig. 3) is used in the field circuit to limit the output voltage. The main components of the alternator are the rotor, the stator the rectifiers, the two end heads and the drive pulley (Fig. 2).

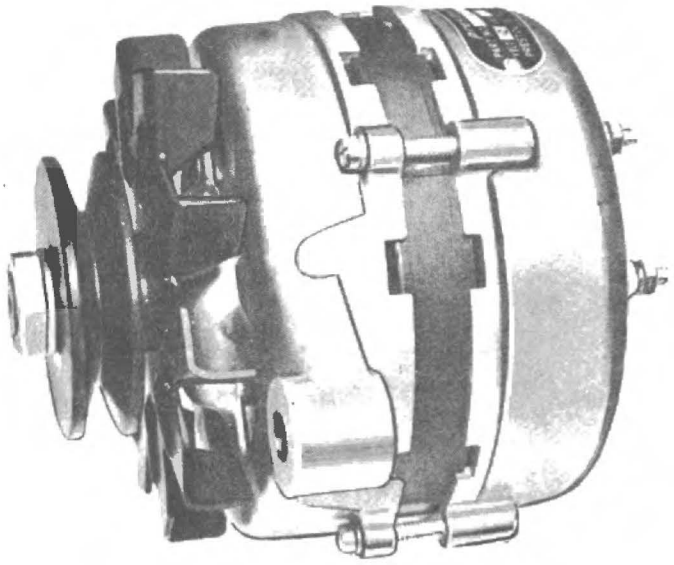


Fig. 1 - Alternator.

Rotor

The rotor or field (Fig. 4) consists of a circular field coil, encased by two end pole pieces, each having four protruding fingers spaced 90° apart. In assembly the four protruding fingers (of each end pole piece) are alternately spaced providing eight poles. Since the end pole pieces have different polarity this in effect provides an eight pole rotating electro magnet.

The ends of the field coil winding are connected to the slip rings at the rear end of the rotor.

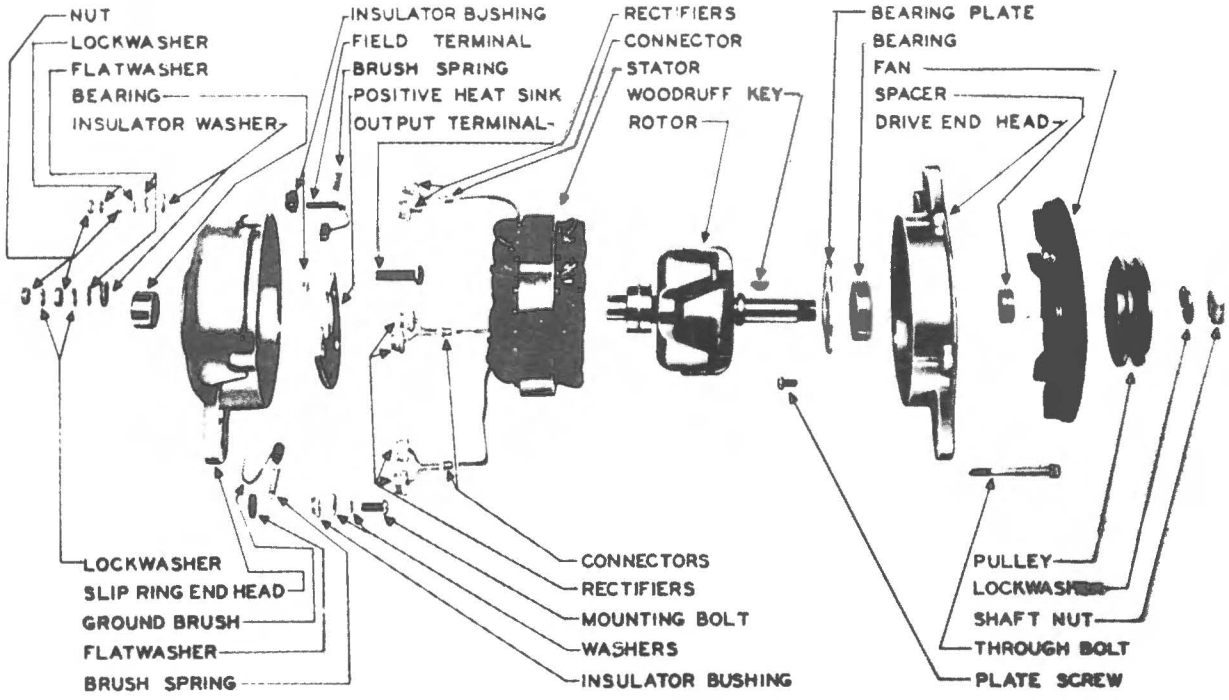


Fig. 2 - Alternator - Exploded View.

The field coil is externally excited by means of battery current. The battery current is supplied to the field coil winding through the ignition switch, the voltage regulator, the brushes and the slip rings.

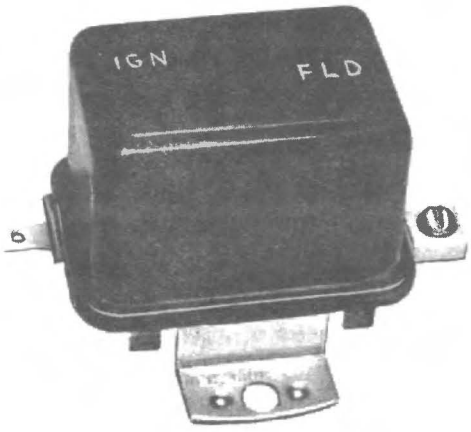


Fig. 3 - Voltage Regulator.

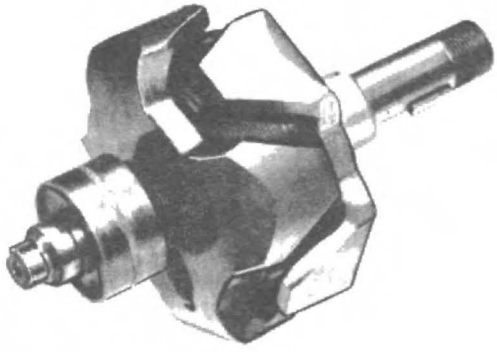


Fig. 4 - Rotor Assembly.

Stator

The stator or armature (Fig. 6) consists of an internally slotted laminated stationary armature, having three separate sets of windings. One end of each of the windings is connected to a common "Y" connection. The other end of each winding is connected to two rectifiers.

Rectifiers

In order to convert the induced A.C. current in the stator windings into usable D.C. current, six silicon (diode) rectifiers are used (Fig. 5). Three of the rectifiers have positive polarity cases, and are pressed into an insulated aluminium holder called a "heat sink". The heat sink is electrically insulated and is large enough to absorb the

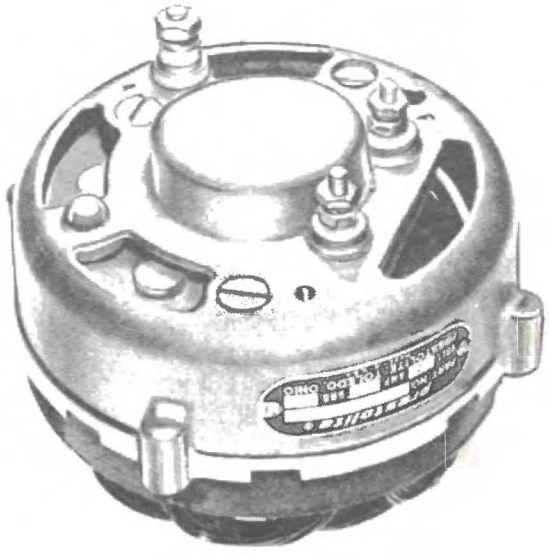


Fig. 5 - Alternator - Connection End.

heat from the positive case rectifiers. The heat sink contains the "out-put" "Bat" terminal.

Three of the rectifiers have "negative" polarity cases, and are pressed into the rear die cast aluminium end head, providing a ground in the circuit.

The silicon rectifiers have a very high resistance to current flow in one direction and very low resistance in the opposite direction. One end of each of the three stator windings is connected to the lead of a positive case rectifier and to the lead wire of a negative case rectifier. The other end of the three stator windings is connected together in a "Y" connection.

The rectifiers permit the induced A.C. current of the three stator windings to flow in only one direction to the output "Bat" terminal. In effect this provides D.C. current at the output terminal. Since the rectifiers will permit the current to flow only in one direction, through the output terminal to the battery, and their high resistance in the opposite direction prevents

the flow of battery current to the alternator, their use eliminates the need for a circuit breaker (cut-out relay). FOR THIS REASON THE BATTERY MUST ALWAYS BE CONNECTED WITH THE NEGATIVE TERMINAL TO GROUND. Failure to connect a battery or quick charger with the correct polarity will damage the alternator and regulator.

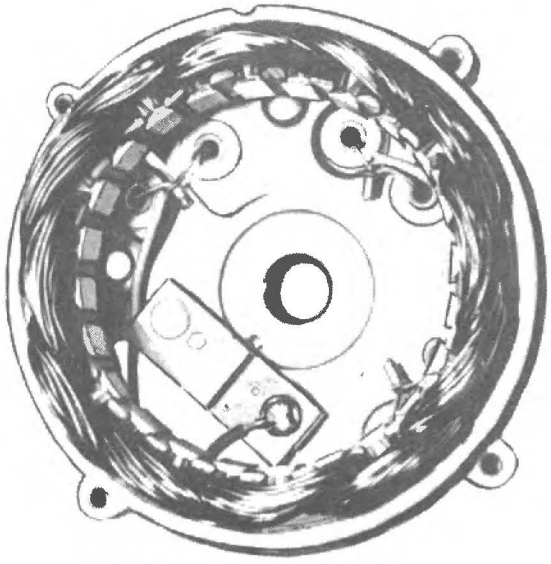


Fig. 6 - Stator and Rectifier End Head Assembly.

End Housings

The two die cast aluminium end heads support and contain the internal parts. The housings are vented at both ends. The rotor shaft is supported at each end by sealed pre-lubricated ball bearings.

Pulley

A pulley, mounted on the front end of the rotor shaft drives the rotor.

2. OPERATION

With the ignition switch turned on, and the engine running, the flow of current through the rotor field coil winding energises an eight pole rotating electro magnet. The rotation of the rotor will cause the stator windings to cut the magnetic lines of force of the rotor. This induces an A. C. voltage in the stator windings. The silicon rectifiers convert the (A. C.) alternating current to (D. C.) direct current at the output terminal, to carry the electrical load and charge the battery.

The silicon rectifiers prevent the battery from discharging through the alternator.

As the rotor speed increases, the induced voltage in the stator windings increases causing more current to flow to satisfy the load requirements. However, there is another factor, commonly known as "inductive reactance" which has an important bearing on current control.

"Inductive reactance" is a counter voltage (voltage of opposite polarity) which is also induced in the stator windings. This voltage tends to oppose the "induced" voltage in the stator windings.

As the rotor speed increases, the counter voltage also increases. By designing the correct size and shape of rotor and stator the selection of the correct size and number of windings, the correct air gap between the rotor poles and stator, and other design features, the alternator permits "inductive reactance" to limit output current, therefore, no current regulator is needed.

3. VOLTAGE REGULATOR

The only function of the regulator is to limit the output voltage. The voltage regulator accomplishes this by controlling the flow of current in the rotor field coil, and in effect, controls the strength of the rotor magnetic field.

The voltage regulator (Fig. 3) is connected in the field circuit between the battery and the field terminal of the alternator. One terminal of the regulator is marked "IGN" and the other is marked "FLD". The "IGN" terminal of the regulator is connected to the coil side of the ignition switch, so that the field circuit is completed only when the ignition switch is turned on.

The voltage regulator (Fig. 7) has two sets of contacts using a common single armature. The upper and lower stationary contact brackets are mounted on a moulded plastic bracket which is attached to the regulator frame by a screw.

The upper contact bracket is connected to the "IGN" terminal. The lower contact bracket is connected to ground. The armature to the insulated "FLD" terminal.

Two resistance units are used (Fig. 8). Resistor number one is connected between the "IGN" and "FLD" terminals in parallel with the upper set of contacts.

Resistor number two is connected between the "FLD" terminal and ground. Its function is to reduce arcing at the regulator contacts.

A voltage coil, consisting of many turns of fine wire, is connected in series between the "IGN" terminal of the regulator and ground. Thus, when the ignition switch is turned on, battery voltage applied to the windings energises the coil and the magnetic force of the coil tends to attract the regulator armature.

Regulator Operation

(1) When the battery line voltage is relatively low, the current flow through the voltage coil will be low. The magnetic force (or pull) of the voltage coil will not be great enough to overcome the regulator armature spring tension which is holding the armature contact against the upper stationary contact (Fig. 7).

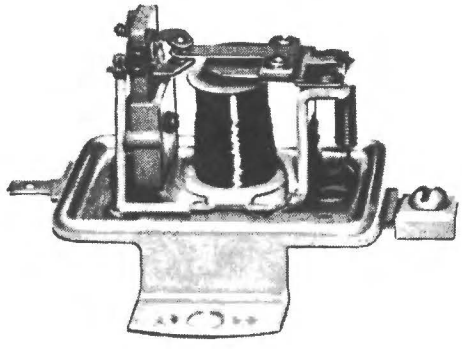


Fig. 7 - Voltage Regulator Cover Removed.

Battery line voltage applied to the "IGN" terminal causes current to flow through the regulator upper contacts through the "FLD" terminal of the regulator and to the insulated brush and rotor slip ring. The rotor field coil circuit is completed to ground through the other rotor slip ring and the ground brush. Inasmuch as the upper contacts are closed, the field circuit resistance is low, and maximum current will flow through the rotor field coil. The rotor field strength will be high, and the alternator output will be at its maximum for any given rotor speed.

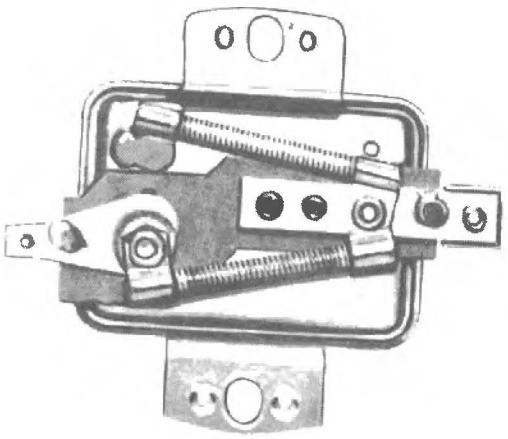


Fig. 8 - Voltage Regulator Resistance Units.

(2) As the battery line voltage increases the magnetic pull of the voltage coil overcomes the armature spring tension and opens the upper contacts. The armature contacts at this time do not touch either the upper or lower stationary contacts. Field current now flows through the regulator "IGN" terminal, through resistance number one through the "FLD" terminal, and through the rotor field to ground.

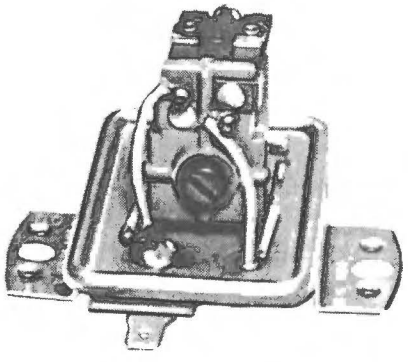


Fig. 9 - Voltage Regulator Top View.

The resistor, in series with the field circuit, reduces the field current and rotor field strength with a corresponding reduction in alternator output. This momentarily reduces battery line voltage applied to the regulator voltage coil. The regulator armature spring tension overcomes the magnetic pull of the voltage coil, closing the upper contacts. When the electrical load requirements are relatively high, the regulator armature oscillates, opening and closing the upper contacts. This alternately "puts in" and "takes out" resistance in the field circuit, and in effect limits the alternator output voltage.

(3) When the electrical load requirement is low and the engine speed is high, the alternator output voltage tends to increase. The battery line voltage (now slightly increased) causes the regulator voltage coil magnetic force to pull the armature contact against the regulator lower stationary contact. This momentarily grounds the end of the field winding and output drops. As this movable contact vibrates between the "float" position and the lower contact system voltage is controlled within very close limits for high speed minimum load operation.

4. TESTING THE ALTERNATOR SYSTEM (On Vehicle)

Testing the alternator charging circuit may be done as a part of a periodic maintenance inspection, or in the diagnosis of charging system difficulties. In either case, the procedure and test preparations are the same.

Circuit Tests

Before any tests are made on the alternator or regulator, the battery should be checked and the circuit inspected for faulty wiring or insulation, loose or corroded connections and poor ground circuits. Check alternator belt tension to be sure the belt is tight enough to prevent slipping under load. Any unfavourable conditions noted in this inspection should be corrected as required before proceeding with electrical tests.

NOTE: The ignition switch should be off and the negative battery cable disconnected from the battery before making any test connections. Failure to observe these steps may result in damage to the system.

Battery test. Test the battery with a hydrometer or voltmeter. If not fully charged, it should be removed and placed on charge. A fully charged battery may be installed for test purposes.

Charging Circuit Resistance Tests (Fig. 10)

NOTE: Disconnect battery ground cable to avoid accidental shorting.

(1) Disconnect the charging circuit lead from the alternator output terminal.

(2) Connect an ammeter in series between the alternator output terminal and the disconnected charging circuit lead.

THE AMMETER LEADS AND TEST AMMETER MUST BE IN GOOD CONDITION AND ALL CONNECTIONS SHOULD BE CLEAN AND TIGHT.

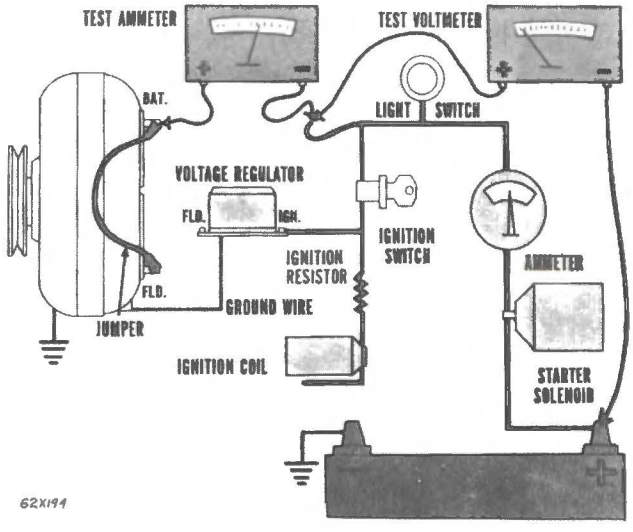


Fig. 10 - Charging Circuit Resistance Test.

(3) Connect a volt-meter (calibrated in tenths) positive lead to the charging circuit disconnected lead and the negative lead to the battery positive post.

(4) Disconnect the lead from the regulator field terminal and then from the alternator field terminal.

(5) Connect a jumper lead from the alternator field to alternator output terminals.

(6) Reconnect the battery ground cable.

(7) Start engine and adjust the speed and electrical load to obtain 10 amperes in the charging circuit. The voltage drop through this circuit should not exceed .3 volts. If more, locate and correct the high resistance before proceeding with tests in the following manner.

Continue with the 10 ampere charge rate and test at the following positions for high resistance:-

(a) Voltmeter connected between battery positive post and IGN terminal of voltage regulator. V-meter reading should not exceed .1 volts maximum.

(b) Voltmeter connected between voltage regulator base and alternator housing. Voltmeter reading should not exceed .04 volts maximum.

(c) Voltmeter connected between battery negative post and alternator housing. Voltmeter reading should not exceed .04 volts maximum.

If the reading is in excess of the above figures locate and correct the high circuit resistance connection.

Current Output Test (Fig. 11)

NOTE: Disconnect battery ground cable to avoid accidental shorting.

(1) Disconnect the field lead at the alternator and at the regulator.

(2) Connect an ammeter in series between the alternator out-put terminal and the disconnected charging circuit lead.

(3) Connect a jumper wire between the alternator out-put terminal and the alternator field terminal.

(4) Connect a volt-meter positive lead to the alternator out-put terminal and the negative lead to the alternator housing.

(5) Connect a carbon pile rheostat across the battery being sure it is in the "OFF" position before connecting leads.

(6) Connect the battery ground cable.

(7) Install a tachometer, start the engine, and adjust the engine speed to 1, 800 RPM.

(8) Adjust the carbon pile rheostat to obtain 14.2 volts on the test volt-meter. Note the reading on the ammeter which should be 35 amps minimum.

Turn off immediately when test is completed.

A slightly low ammeter reading may indicate an open rectifier while a considerably lower reading may indicate a shorted rectifier. Usually the alternator will hum or growl with a shorted rectifier.

In either case, the alternator should be removed and tested on the beach before disassembly. Before the alternator is removed and while the ammeter is connected in the circuit it is possible to test the rotor field current draw.

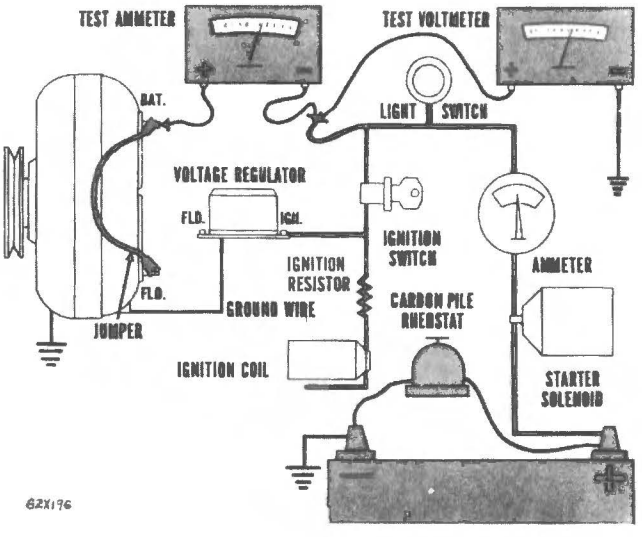


Fig. 11 - Current Output Test.

(9) With the engine stopped, note the reverse current reading on the ammeter, and the battery voltage reading on the voltmeter. The rotor field coil draw should be 2.0 amps to 2.3 amps at 10 volts. (If the test ammeter does not have a reverse current scale), reverse the test ammeter leads at the "out-put" terminal of the alternator and the charging circuit lead. A low rotor field coil draw is an indication of high resistance in the field coil circuit. The cause may be brushes, slip rings, or the field coil connections. A high rotor field coil draw indicates a possible shorted field.

Voltage Regulator Test (Fig. 12)

NOTE: Engine at normal operating temperature with a fully charged battery.

Two tests are required to determine whether or not the regulator is performing properly. The first step determines the regulator's ability to control voltage at low speed and relatively high load. Under these conditions the regulator movable contact is vibrating against the upper contact. The second test determines the regulator's ability to control voltage at higher speeds and minimum load.

Since this regulator is temperature compensated, the entire charging system must be temperature-normalized and regulator temperature must be taken into consideration.

This means that there are three basic factors that affect voltage regulator performance.

1. Engine speed.
2. Electrical load or current as measured by a test ammeter.
3. Voltage regulator temperature.

Test Preparation

Remove the field jumper lead used in the previous tests and reconnect the field lead to the alternator and regulator field terminals in this order.

CAUTION: Be sure the ignition switch is off when connecting the field lead. Grounding of the field circuit while the ignition switch is on may damage the regulator.

The ammeter remains connected as in the previous tests with the volt-meter negative lead to earth and the positive lead to the ignition terminal of the voltage regulator.

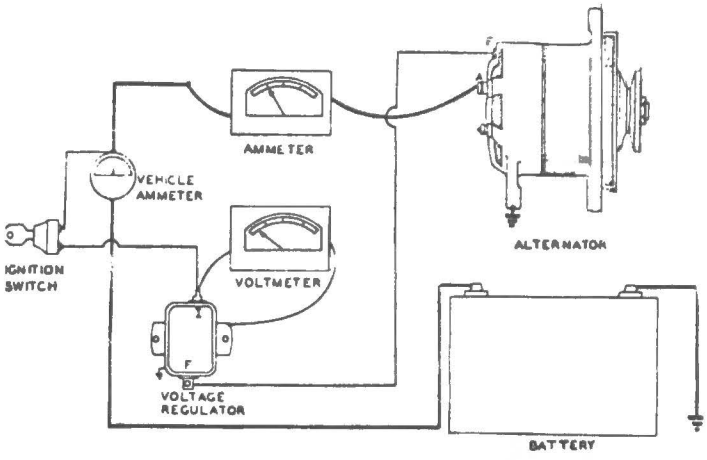


Fig. 12 - Voltage Regulator Test.

Upper Contact Test

(1) Start the engine and adjust the engine speed to 850 RPM.

(2) Turn on lights and/or accessories to obtain a 10 amperes charge rate. Operate the system at this speed and load for 15 minutes to normalise the temperature. (This regulator is temperature compensated).

(3) Cycle the system by stopping and restarting the engine.

(4) Increase engine speed to 1,200 RPM and adjust lights and/or accessory load to obtain 12 amperes charge rate.

(5) Read and record the ambient temperature two inches from the regulator cover.

(6) Read and record the voltage registered on the test voltmeter. Compare this voltage with the voltage temperature

specifications tabulated below. (If seriously out of adjustment a rough setting may be made).

Temp. °F	50°	70°	90°	110°	130°	150°
Volts (Min.)	14.1	14.0	13.85	13.7	13.6	13.45
(Max.)	14.5	14.4	14.25	14.1	14.0	13.85

Lower Contact Test

1. Increase engine speed to 1750RPM.

2. Turn off all lights and/or accessories. Voltage should increase and amperage should decrease to 3-5 amperes.

3. Measure temperature to make sure it is the same as it was for the upper contact test.

4. Read the test voltmeter and note the exact amount that voltage has increased from the voltage reading obtained with the regulator operating on the upper contacts.

5. The voltage increase should not be less than .1 volt nor more than .7 volts.

6. Check using a 15 ampere load while the engine is operating @ 1750 RPM. Switch the load on and read the voltmeter - switch the load off and wait 15 seconds, then again read the voltmeter. The difference between the two readings is the "spread".

The final regulator reading may now be made after cycling the system - adjust if necessary.

If the voltage "spread" is greater or less than specified, remove the regulator cover and adjust by loosening the stationary contact support screw and moving the support up or down. (A small amount of up or down movement will usually make quite a change in spread). Raising the stationary support will increase the voltage "spread".

Replace the cover and increase speed to 1200 RPM and adjust lights and/or accessory load to obtain 12 amperes. If the voltage setting is not within specifications on test voltmeter, remove the cover and adjust by bending the lever spring hanger.

(Use insulated spring hanger bending tool).

Adjusting the spring tension requires removal of the regulator to remove the cover. The spring tension may then be adjusted by bending the lower spring hanger down to increase tension and increase the voltage setting, or bend up to decrease voltage.

It is recommended that adjustment be performed as follows:

(a) Shut the engine off before removal of the regulator. The wiring connections to the regulator can then be left connected without danger of a short circuit while the adjustment is made.

(b) A very slight movement of the spring hanger makes considerable difference in voltage reading. It is possible that several adjustments will be necessary to obtain the correct voltage setting.

(c) To prevent the necessity of removing and installing the regulator several times between adjustments, it is permissable to connect a ground wire (jumper) between the base of the regulator and a good ground. However, to ensure that a short circuit does not occur during tests the regulator must be insulated from the car by a fender cover or other insulating material.

(d) During the test the cover must be in place and the regulator placed in the same position (same angle) as when installed on the car.

(e) After each test the ignition switch should be turned off whilst an adjustment is being made. This will not only protect against an accidental short circuit that would damage the regulator, but also de-magnetize the regulator. If the regulator is not de-magnetized the meter readings after an adjustment are not accurate.

If the alternator and regulator tested satisfactorily, turn the ignition switch "off". Then disconnect the battery ground cable. Disconnect the test instruments. Correctly connect the leads at the alternator and the regulator. Connect the battery ground cable.

BE SURE THE NEGATIVE POST OF THE BATTERY IS ALWAYS CONNECTED TO

GROUND. INCORRECT BATTERY POLARITY CAN DAMAGE THE ALTERNATOR RECTIFIERS. DO NOT GROUND THE ALTERNATOR FIELD CIRCUIT AS THIS MAY DAMAGE THE REGULATOR.

5. SERVING THE REGULATOR.

If the regulator voltage is unstable or cannot be adjusted to specifications in the above tests, remove the regulator from the vehicle for further tests and adjustments.

(1) Voltage Regulator Contact Gap: Contact gap is checked by placing the proper gauge between the lower movable contact and the lower stationary contact. Adjust by bending the upper stationary contact up or down. Be careful that proper contact alignment is maintained.

(2) Voltage Regulator Core Gap Adjustment: To check the voltage regulator armature core gap, connect a No. 57 bulb in series with a 12 volt battery between the regulator "F" terminal and base.

Place a round wire gauge between the armature and core, and on the side of the brass stop rivet nearest the centre of the core head. Care should be taken not to press on the contact reed as this will affect the reading. (See specifications for gauge size).

The lower movable armature contact should barely touch the lower stationary contact when the armature is pressed down against the small end of the gauge and the lamp should brighten. With the large end of the gauge between the armature and core, the light should remain dim.

To adjust to the above specifications, loosen the stationary bracket attaching screw and move the bracket up or down.

NOTE: This is a preliminary adjustment only, as the core gap may be changed when voltage "spread" is established as covered in "Voltage Regulator Test" above.

Servicing Regulator Contacts

The contacts on the voltage regulator may be cleaned, if rough or oxidized, with a fine cut file. (Use care not to remove an excess of contact material). After filing, the contacts should be cleaned with a strip of lint-free tape saturated with a few drops of lighter fluid and drawn between the contacts. Then repeat with a dry strip of tape to remove residue.

6. DISASSEMBLY OF ALTERNATOR

(1) Remove the through bolts and separate the stator from the drive end head with the blade of a screwdriver. Be careful not to lose the brushes and springs which will fall out of the holders as the rotor is withdrawn.

(2) The brush holders may be taken from the end head by removing the two studs taking care to note the assembly of insulating washers and bushes in order that these may be re-assembled in the correct manner.

(3) The positive heat sink is held by two studs and care must be taken to note the positioning of insulating washers and bushes to ensure correct re-assembly.

(4) The slip-ring end bearing is a push fit on the rotor shaft and will be retained on the

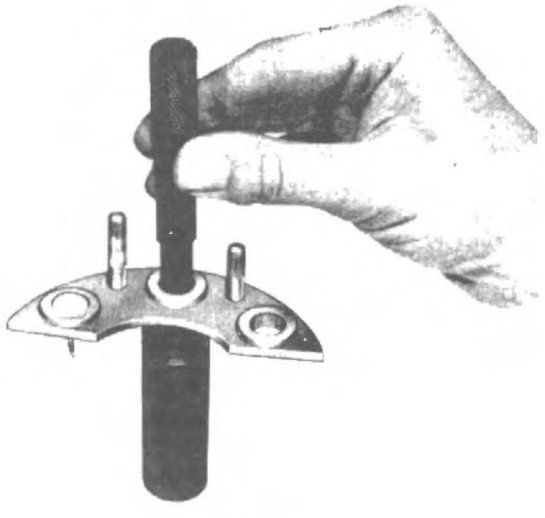


Fig. 13 - Removing Rectifi -s from Heat Sinks.

rotor as it is withdrawn from the end head. The outer race of this bearing is prevented from rotating in the end head by the use of an "O" ring. This rubber "O" ring should be replaced every time the alternator is disassembled.

NOTE: To remove the slip ring end bearing, Tool CA-3615 can be used by modifying the end of the screw in the following manner to allow the screw to pass through the internal diameter of the bearing.

(1) Grind the end of the screw to 23/64" diameter for a distance of 7/16".

(2) Turn a $\frac{1}{2}$" radius on the end of the ground section to allow the tool to centre itself on the end of the rotor shaft when tightening.

(3) Harden the ground section of the screw.

(5) If the rectifiers must be replaced support the heat sink or the end head (see Fig. 13) and press out. Do not hammer. Both positive and negative rectifiers are removed in the same manner. Use Tool No. CA-3771.

(6) To separate the drive end head from the rotor assembly remove the pulley nut. If necessary use rope or wood to grip the pulley in a vice while removing the nut. Do not grip the rotor poles in the vice as they may be damaged.

The pulley, key, fan and spacer may now be withdrawn and the rotor assembly pulled through the bearing. This bearing is a sliding fit on the shaft and is locked in position by the shaft nut and intervening components.

The outer race of the bearing is clamped in the drive end head by a plate retained by three screws, removal of these will allow the bearing to be pressed from the head.

(7) Upon completion of disassembly all parts should be wiped clean and inspected for wear, distortion or signs of overheating or mechanical interference.

(8) The stator should be inspected for insulation failures or defects. A shorted phase winding or rectifier will normally be evident by discolouration. The stator should be tested for grounds and continuity using a 240V test lamp.

7. ALTERNATOR SERVICE

Testing The Rectifiers (With Tool CA-3829)

The rectifier tester Tool CA-3829 provides a quick, simple and accurate method of testing the alternator rectifiers without the necessity of disconnecting the soldered rectifier leads.

With the alternator rectifier end shield separated from the drive end housing, proceed with the rectifier tests as follows:

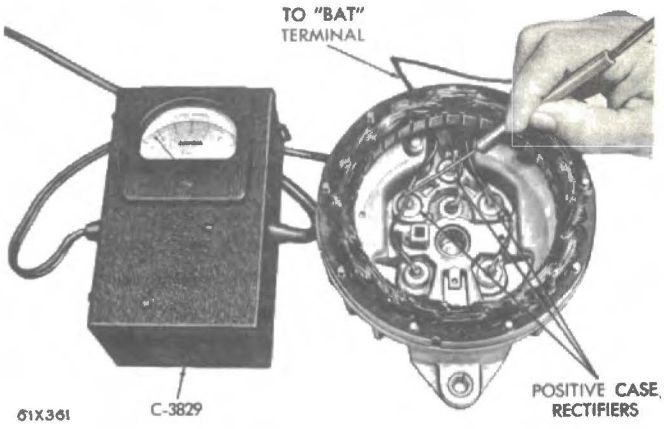


Fig. 14 - Testing rectifiers (Tool CA-3829).

Positive Case Rectifier Test (Fig. 14)

(a) Place the alternator on an insulated surface. Connect the test lead clip to the alternator "Bat" output terminal.

(b) Plug in the Tool CA-3829, power source lead into a 240 A.C. power supply. Touch the exposed bare metal connections of each of the positive case rectifiers, with a test prod.

CAUTION: Do not break the sealing around the rectifier lead wire, or on the inner end of the rectifier. The sealing material is for protection against corrosion. Always touch the test prod to the exposed metal connection nearest the rectifier.

The reading for satisfactory rectifiers will be $1\frac{3}{4}$ amperes or more. The reading should be approximately the same for the three rectifiers.

When two rectifiers are good and one is shorted, the reading taken at the good rectifier will be low, and the reading taken at the shorted rectifier will be zero. Disconnect the lead to the rectifier reading zero and retest. The reading of the good rectifier will now be within the satisfactory range.

When one rectifier is open it will read approximately one ampere, and the two good rectifiers will read within the satisfactory range.

Negative Case Rectifier Test

(a) Connect the test lead clip to the rectifier end head.

(b) Touch the exposed connection of each of the negative case rectifiers with a test prod. The test specifications are the same, and the test results will be approximately the same as for the positive case rectifiers except the meter will read on the opposite side of the scale.

Field Coil Draw

(a) Connect one lead of a test ammeter to one terminal of a fully charged battery. Connect a jumper wire to the other terminal of the battery and ground it to the alternator end head. Connect the other ammeter lead to the field terminal of the alternator.

(b) Slowly rotate the alternator rotor by hand. Observe the ammeter reading. The field coil draw should be 2.1 amperes at 10 volts.

NOTE: A low rotor draw indicates a high resistance in the field coil circuit (brushes, slip rings or rotor coil). A higher rotor draw indicates a possible shorted rotor coil or a grounded rotor.

Testing Alternator Field Circuit For Grounds

The alternator must be disassembled for the performance of this test which must be carried out on the rotor and insulated brush holder separately.

(a) Insulated Brush Holder. Touch one prod of a 240 volt test lamp to the insulated brush holder and the other prod to the end head. The lamp must not light.

(b) Rotor. Touch one prod of a 240 volt test lamp to one of the slip rings and the other to a rotor pole. The lamp must not light.

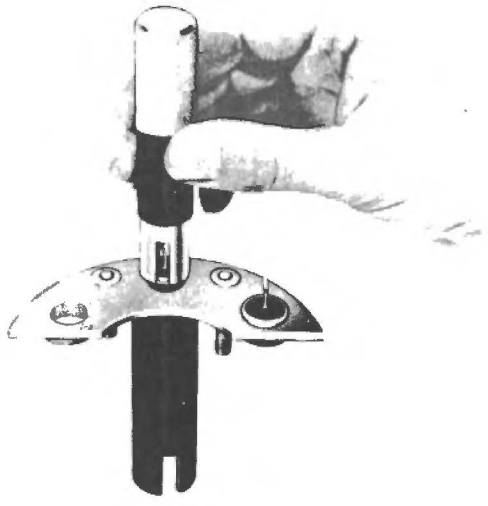


Fig. 15 - Installing Rectifiers in Heat Sinks.

8. ASSEMBLY

(1) Make sure that the snap ring and retainer cup are in place on the rotor shaft at the drive end.

(2) Assemble drive end head complete with bearing to the rotor then assemble spacer, fan, key, pulley, lockwasher and shaft nut and tighten nut to 30 lbs./ft. torque.

(3) Install diodes using Tool CA-3772 (Fig. 15). A press must be used and not a hammer. While resoldering the connections to the diodes, hold the wire lead with pliers as this will help to dissipate heat and thus protect the diode from damage due to over-heating.

(4) Install the brushes and springs in the holders and retain them in position clear of the slip-ring by means of a piece of stiff wire inserted through the hole in the end head provided for this purpose (Fig. 16).

(5) Assemble the rotor and drive end head into the stator to which the slip-ring head is already connected, position lugs and insert and tighten frame screws.

(6) Remove wire allowing brushes to bear on slip-rings and ensure that rotor turns freely by hand.

(7) Install on vehicle and test operation.

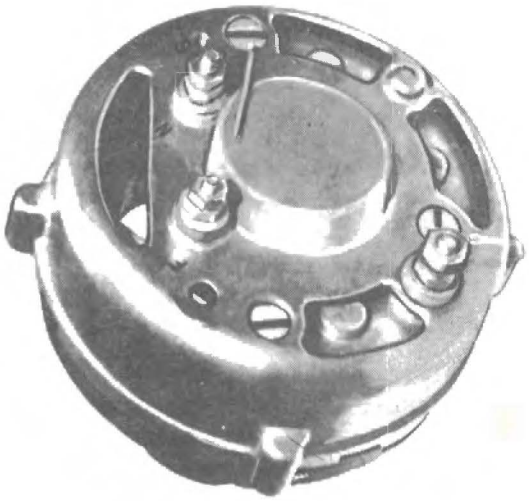


Fig. 16 - Alternator S.R. Head showing wire inserted to restrain brushes during assembly.

PART 4 — IGNITION SYSTEM
6 CYLINDER
SPECIFICATIONS

DISTRIBUTOR

Type	Bosch U-ZV/JCU 6RI

Advance - Centrifugal (Distributor degrees at Distributor r. p. m.)

Deg. Adv. (Total)	Begin R. P. M.	5° R. P. M.	10° R. P. M.	END R. P. M.
10.5° - 12.5°	330-480	700-850	1400-2100	2000-2300

NOTE: A decrease in rate of advance (kink in advance curve) occurs at 8° advance.

Advance - Vacuum (Distributor degrees at Inches of Mercury).

Deg. Adv. (Total)	Begin at Ins. Mercury	End at Ins. Mercury
5.5° - 7.5°	5 - 7⅛	13

Breaker point gap	.012" - .016"
Dwell angle	36° to 40°
Breaker arm spring tension	14 - 17½ ozs.
Timing:	
Manual transmission	2½° B. T. C.
Automatic transmission	5° B. T. C.
Condenser capacity	0.275 mfd + 15%
Shaft side play	.000" to .003"
Shaft end play (after assembly)	.003" - .010"
Rotation	Clockwise

SPARK PLUGS

Type	N 14 Y
Size	14 m. m.
Gap	.035"
Firing order	1-5-3-6-2-4

COIL

Type	UZS/OK 12 N6-4
Test - spark gap (coil)	11/32" spark when primary current is adjusted to 1. 7 amp.
Ballast resistor	Chrysler

SPECIAL TOOLS

* EFAW 57	Distributor point setting tool
* EFAW 105	Ignition tester

* Bosch tool numbers.

SERVICE DIAGNOSIS — CONDITIONS — POSSIBLE CAUSES

1. BURNED OR PITTED DISTRIBUTOR POINTS

(1) Dirt or oil on points.

(2) Points misaligned or gap too narrow.

(3) Defective coil.

(4) Ballast resistor not in circuit.

(5) Wrong condenser or defective condenser.

(6) Defective ignition switch.

(7) Alternator regulator setting too high.

(8) Bushings or distributor shaft worn.

(9) Touching point faces with fingers during installation.

(10) Weak contact breaker arm spring.

2. IGNITION COIL FAILURE

(1) Regulator setting too high.

(2) Coil damaged by excessive heat from engine.

(3) Coil case or tower cracked.

(4) Ignition coil windings or series resistance defective.

3. CONDENSER FAILURE

(1) Normal fatigue.

(2) Damaged by excessive heat or moisture.

4. FOULED SPARK PLUGS

(1) Carburettor mixture too rich.

(2) Excessive oil consumption.

(3) Incorrect plug heat range.

(4) Incorrect gap adjustment.

5. BURNED SPARK PLUGS

(1) Plugs loose or too tight in cylinder head.

(2) Carburettor mixture too lean.

(3) Incorrect plug heat range.

(4) Incorrect ignition timing.

(5) Leaking head gasket or cracked cylinder head.

SERVICE INFORMATION — PROCEDURES
6 CYLINDER

1. GENERAL INFORMATION

The ignition system consists of two separate circuits. The battery, ampmeter, ignition switch, ballast resistor, primary winding of the ignition coil distributor contacts and condenser, vehicle frame, and the primary wiring make up the low voltage primary circuit.

The secondary high voltage circuit includes the coil secondary winding, the distributor cap and rotor, the high tension wiring, the spark plugs and the vehicle frame. The distributor housing contains the automatic advance mechanism and the contact breaker assembly. A vacuum control advance unit, whose diaphragm is mechanically connected to the movable section of the contact breaker assembly, is mounted on the outside of the housing. An extension of the distributor housing carries the bearing bushes for the drive shaft; this part fits into the engine block and the drive is taken from the engine camshaft.

2. OPERATION

Rotation of the distributor shaft by the engine drives the distributor cam through the driving plate and centrifugal weights. The cam can rotate through a predetermined number of degrees in the direction of rotation. This operation is transmitted by the outward movement of the weights and controlled by the springs (Fig. 1). The cam lobes contact the rubbing block of the contact breaker lever and open the points, breaking the primary circuit. The spark which is produced by the coil is directed to the centre tower of the

distributor cap, from where it is distributed by the turning rotor, to the cap segments and then to the spark plugs.

The vacuum control unit provides an additional timing device operating in accordance with engine load. A link from the diaphragm turns the contact breaker plate against the direction of rotation (Fig. 2). The relationship between degrees of advance and applied vacuum is controlled by spring tension opposing advance diaphragm movement.

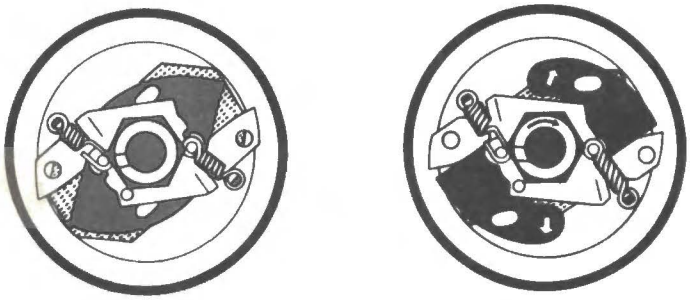


Fig. 1 - Centrifugal advance mechanism.

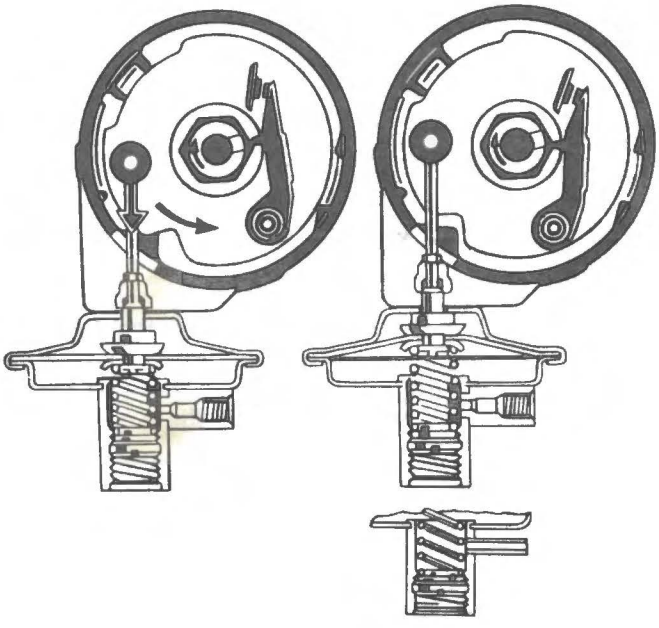


Fig. 2 - Vacuum advance mechanism.

REMOVING DISTRIBUTOR

(1) Disconnect vacuum hose at distributor.

(2) Disconnect primary lead wire at coil.

(3) Unfasten distributor cap retaining clips and lift off the distributor cap.

(4) Rotate the engine crankshaft until the distributor rotor is pointing toward the cylinder block. Scribe a mark on the block at this point to indicate the position of the rotor for reference when reinstalling the distributor.

(5) Remove the distributor hold-down lock plate screw.

(6) Carefully lift the distributor from the engine, the shaft will rotate a small amount as the distributor gear is disengaged from the camshaft gear.

4. SHAFT AND BUSHING WEAR TEST

(1) Remove the distributor rotor.

(2) Disconnect the primary lead wire at the distributor terminal. Do not loosen the movable contact arm spring retaining unit.

(3) Clamp the distributor hold down clamp in a vice equipped with soft jaws and apply only enough pressure to restrict any movement of the distributor, during the test.

(4) Attach a dial indicator to the distributor housing so that the indicator plunger arm rests against the movable breaker arm at the rubbing block (Fig. 3).

(5) With the rubbing block at the breaker arm on the highest point of a cam lobe, place one end of a wire loop around the top of the distributor shaft. Hook a spring scale in the other end of the wire loop and pull on a line with the plunger of the indicator gauge.

The wire loop must be down on the distributor shaft to ensure a straight pull; also be sure that the wire loop does not interfere with the indicator or indicator holding bracket. Apply a 5 lb. pull and read the movement of the plunger on the indicator dial. (Be sure the rubbing block of breaker arm is on the highest point of the cam lobe during this test). If the plunger movement exceeds .006", replace the bushings and/or distributor shaft.

5. DISASSEMBLY OF DISTRIBUTOR

To disassemble distributor refer to Fig. 4 and proceed as follows:

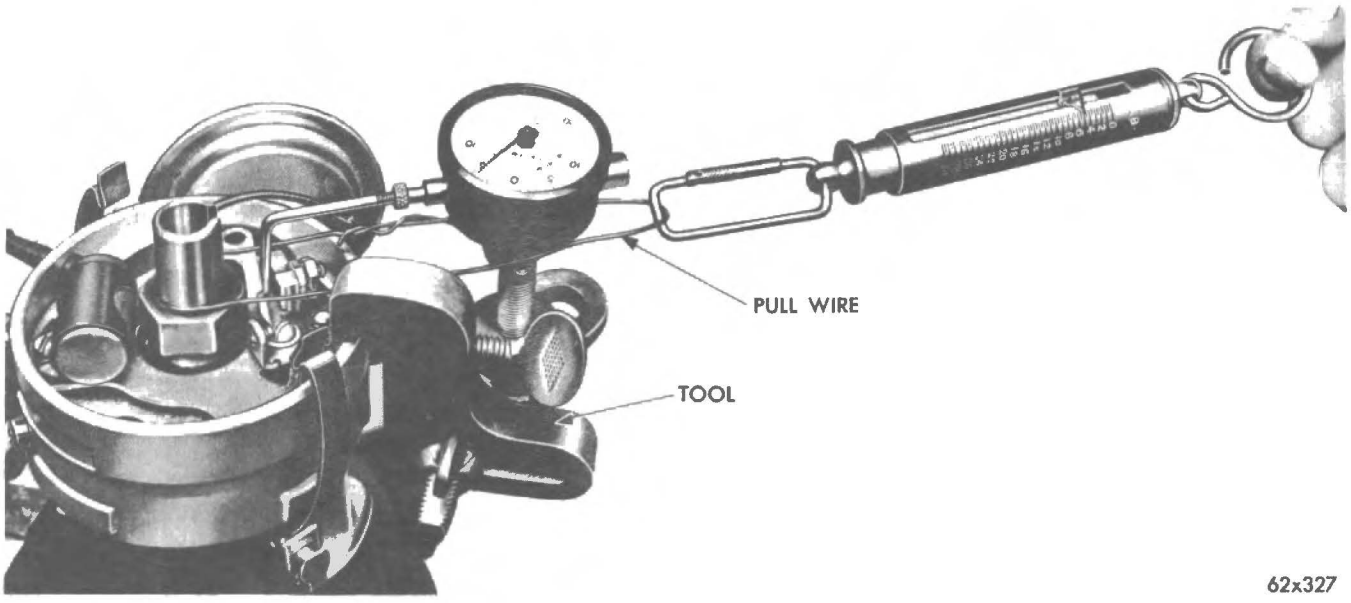


Fig. 3 - Checking distributor shaft side play (typical).

(1) Remove primary terminal by unscrewing the outer nut, and condenser (14) by removing two screws (13).

(2) Remove screw (6) and link (7) which connects the diaphragm actuating link to the contact breaker plate.

(3) Remove two screws (18) and detach the vacuum control unit (19) from the distributor housing.

(4) Remove two screws (15) holding the spring clips to the housing and threaded into the contact breaker plate (8) and withdraw plate from the housing.

(5) Press out driving pin (20) securing drive gear and remove gear (21).

(6) Push shaft (12) from housing by applying light pressure to the drive end.

(7) Unhook advance control springs (11) from brackets, remove circlip (9) from cam centre and cam (10).

(8) Remove spring clip (3) screw (4) and contact set (5).

6. CHECKING DISMANTLED DISTRIBUTOR COMPONENTS

(1) Test condenser using a suitable tester (Tool EFAW 105). The body of the condenser must make good contact with the distributor housing, and the connecting wire must be properly connected to the terminal together with the contact breaker lead.

(2) Contact points must not be loose or misaligned in relation to each other. Displaced or distorted contact points should be aligned using a suitable setting tool (Tool EFAW 57). The rubbing block at the contact breaker lever should not show excessive wear. Burnt contact surfaces can be redressed if the pitting and piling is not excessive.

(3) Contact spring tension must be tested with a spring balance and should be within 14 - 17.5 ozs. If the contact set cannot be serviced to meet these requirements it must be replaced. Distorted or stretched advance springs must be replaced with the correct springs as these springs determine the advance curve which is important to optimum engine performance.

(4) The vacuum control unit must be tested for leaks and in the event of a leak being found the complete unit must be replaced.

7. REASSEMBLY OF DISTRIBUTOR

To assemble distributor, reverse disassembly procedure.

> NOTE: Cleanliness is essential. Oil and grease must be kept away from the electrical contact surface and insulating parts.

The earth lead connected to the inside of the vacuum control unit must have its terminal placed under the screw (6).

Shaft Bushings

New sintered bushings should be soaked in light engine oil (SAE 10W) for one hour before installation. It is important that a correctly fitting mandrel be used for pressing out and replacing bushes. Extreme caution must be exercised not to distort the housing.

Shaft End Play

Shaft end play must be adjusted at the drive end to .003" - .010" by adding or removing shims, from between the drive gear and housing.

Contact Point Opening (Dwell)

Adjust contact point opening by loosening off the lockscrew, and with the aid of a screwdriver move the stationary point until the point gap is .012" - .016" with the rubbing block on the highest point of a cam lobe. Connect cam angle meter, start engine and adjust points to read 36^{o} - 40^{o} of cam dwell. The contact closing period is determined by the shape of the cam and the contact point opening. Each opening should be equal. Align contacts, if necessary to provide extra centre contact by bending the stationary contact bracket. NEVER BEND MOVABLE ARM to obtain alignment.

8. CHECKING BREAKER ARM SPRING TENSION

(1) Hook a spring scale on the breaker arm and pull in a straight line at right angles to point surfaces.

(2) Take a reading as the points begin to separate under the slow and steady pull of the scale. Spring tension should be 14-17.5 ozs.

(3) If tension does not come within this specification a new contact set is required.

> NOTE: Spring tension that is too great will cause excessive wear on the distributor cam and rubbing block. Spring tension that is too weak is unable to keep the points in contact with each other when they close. This becomes more apparent as the engine speed is increased, and can cause high speed misfiring.

9. DISTRIBUTOR ADVANCE

Checking Advance Curve (Centrifugal)

Mount the distributor assembly in a suitable stroboscope - type distributor tester.

(1) Adjust the tester speed control to operate distributor at a slow speed (below point at which centrifugal advance starts to operate), and align the "O" of the tester degree ring with any of the arrow flashes.

(2) Adjust the tester speed control to operate the distributor at speeds called for in Specifications, and observe arrow flashes opposite tester degree ring to determine degrees of advance.

(3) If the centrifugal advance curve does not meet specifications adjust spring tension by bending the spring mounting tabs in the required direction.

Bending the spring tab towards the distributor cam decreases the tension, whilst bending away increases the spring tension. The lighter spring controls the initial advance and the combination of both springs controls the advance at the higher speeds.

To Test Vacuum Diaphragm Leak

With the distributor mounted in a distributor tester and with the vacuum unit attached to the distributor, proceed as follows:

(1) Place thumb over end of vacuum pump hose and adjust the regulator control knob to give a reading of 20" of vacuum with hose closed off to ensure tester hose does not leak.

(2) Attach vacuum pump hose to the tube on the vacuum unit. Vacuum gauges should hold on maximum vacuum obtainable if no leaks exist.

(3) Observe the breaker plate whilst performing leak test to check response of breaker plate to vacuum advance. There should be instant response to the pull of the diaphragm, moving the plate without drag, bind or jerk in either direction.

(4) If leakage is indicated, replace the vacuum unit assembly.

To Check Vacuum Advance Curve

If only the vacuum advance curve is to be checked, connect tester vacuum pump hose to distributor vacuum advance unit and perform operation 1 of centrifugal advance, curve test, then proceed as follows:

(1) Turn tester vacuum pump ON. Adjust vacuum pump regulator to vacuum test specifications. Refer to Specifications and observe arrow flashes on tester degree ring to determine degrees of advance.

(2) If the vacuum advance is below or above specifications, adjustment is available by adding or removing shims between the diaphragm spring and the retaining plug.

NOTE: Be sure to use two spanners to remove this plug - one to hold the diaphragm housing hexagon whilst loosening the plug with the other spanner. This is important as if only one spanner is used, leakage could easily be caused in the diaphragm body.

10. INSTALLATION OF DISTRIBUTOR

(1) Position the distributor on engine.

(2) Engage the distributor drive gear with the camshaft drive gear so that when distributor is fully seated, the rotor will be in line with the line scribed previously on the cylinder block.

(3) Install the hold down lock plate screw and tighten finger tight.

(4) Install the distributor cap (make sure all high tension wires are firmly seated in cap towers).

(5) Attach primary lead to coil.

NOTE: Do not connect the distributor vacuum hose at this time.

(6) Connect a power timing light to the No. 1 spark plug (using proper adaptor).

(7) Start the engine and run at a slow idle.

(8) Rotate the distributor housing so that the timing mark on the crankshaft damper is aligned with the appropriate mark on the chain case cover. Refer to specifications. (Moving distributor housing counter-clockwise advances the timing, and clockwise retards it).

(9) Tighten the distributor lock plate screw after timing has been set and recheck the timing adjustment with a power timing light.

(10) When the timing is correct, reconnect vacuum hose at distributor.

(11) Remove timing light from engine.

11. SPARK PLUGS

Remove the spark plugs, examine the firing ends of plugs for evidence of oil fouling, gas fouling, burned or over heating conditions. Clean and re-set gaps to .035".

Oil fouling is usually identified by wet, sludgy deposits, caused by excessive oil consumption.

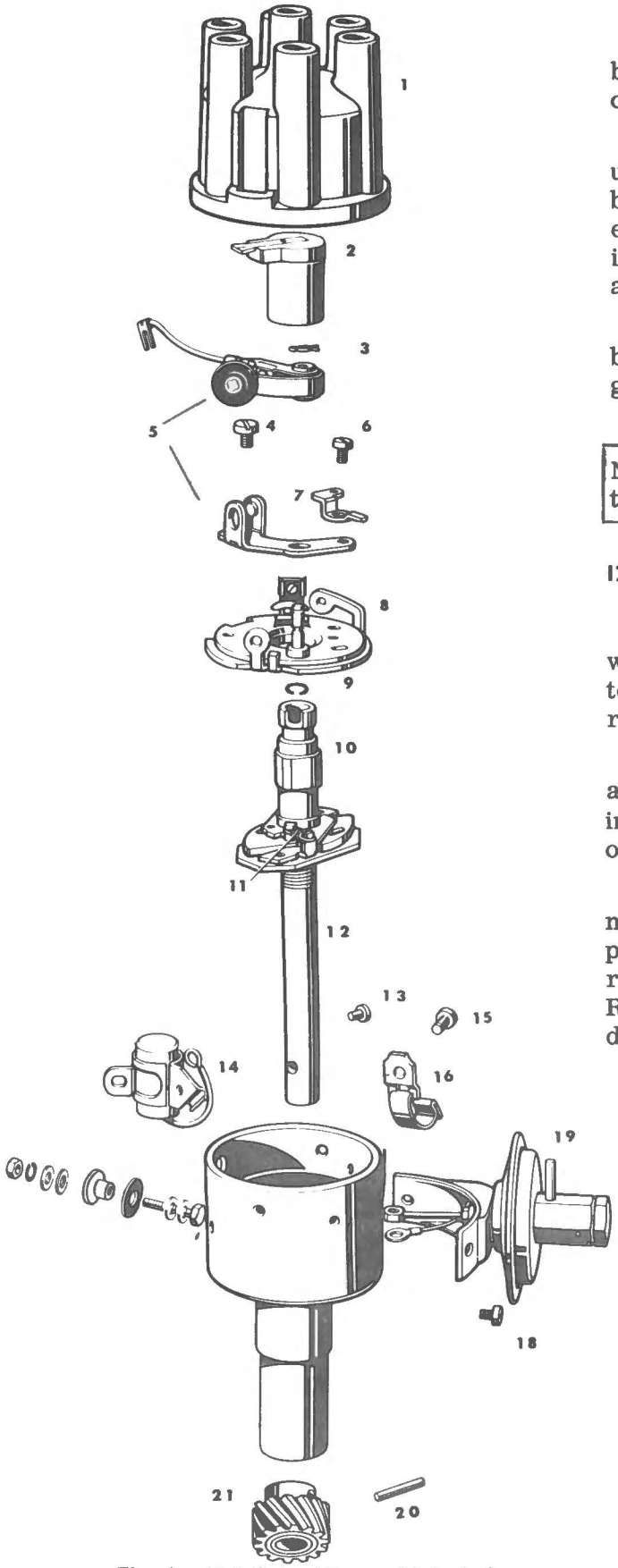


Fig. 4 - Distributor (disassembled view).

Gas fouling is usually identified by dry, black, fluffy deposits, caused by incomplete combustion.

Burned or overheated spark plugs are usually identified by a white, burned or blistered insulator nose and badly burned electrodes. Improper fuel, inefficient cooling, or improper ignition timing normally are the causes.

Normal conditions are usually identified by white powdery deposits or rusty brown to greyish-tan deposits.

NOTE: When installing spark plugs, tighten to 30 lbs./ft.

12. IGNITION COIL

The ignition coil is designed to operate with an external ballast resistor. When testing the coil for output, include the resistor in tests.

Inspect the coil for external leaks and arcing. Always make two tests when checking the coil - one when coil is cold, and the other after the coil has been warmed up.

Test the coil according to the coil tester manufacturers instructions. Test coil primary resistance, test ballast resistor resistance, test coil secondary resistance. Replace any coil and ballast resistor that does not meet specifications.

PART 4A— DISTRIBUTOR V8 CYLINDER

SPECIFICATIONS

IGNITION	
Firing Order	1 8 4 3 6 5 7 2
Ignition Timing	10° B.T.D.C. @ 500 R.P.M.
DISTRIBUTOR	
Direction of Rotation	Clockwise
Make and Number	Chrysler (2444795)
Condenser Capacity	.25 to .285 mfd.
Breaker Point Gap	.014" - .019"
Dwell Angle	28° - 33°
Breaker Arm Tension	17 - 20 ozs.
Advance - Automatic Distributor	
Degrees @ Distributor RPM	0° @ 325 to 475
	0° to 2° @ 475
	5° to 7° @ 830
	8° to 10° @ 1750
Advance - Vacuum Distributor	
Degrees @ inches of mercury	0° @ 7" to 9"
	6° to 9° @ 12"
	10.5° to 13.5° @ 15"
Shaft End Play	.000" to .003"
SPARK PLUGS	
Make	Champion
Type	N 14 Y
Gap	.035"
COIL	
Make and Number	Chrysler (2444242)
Primary Resistance @ 70° to 80°F	1.65 to 1.79 ohms
Secondary Resistance @ 70°F to 80°F	9400 to 11700 ohms
Ballast Resistor:	
Part Number	2095501
Resistance @ 70° - 80°F	0.5 - 0.6 ohms
Current draw (coil & ballast resistor in circuit)	
Engine stopped	3.0 amps
Engine idling	1.9 amps

I. DISASSEMBLY (Fig. 5)

(1) Remove the distributor rotor.

NOTE: The distributor cap clamp springs are held in place by peened metal around the openings and should not be removed.

(2) Remove the retainer attaching the vacuum advance unit to the contact plate advance arm.

(3) Remove the two screws and lockwashers attaching the vacuum advance unit to the distributor housing and remove the unit.

(4) Remove the primary lead wire and rubber grommet as an assembly. Push the grommet towards the inside of the distributor to remove. Do not pull on the wire.

(5) Remove the two screws, and lockwashers attaching the contact plate to the housing and lift out the contact plate, contacts and condenser as an assembly.

(6) Remove the oil wick from the distributor cam. Remove the spring clip from the oil well in the cam and remove the cam and yoke assembly and spacer.

(7) If the side play exceeded .006 inch replace bushing and/or distributor shaft as follows :

a. Remove the distributor drive collar retaining pin and slide the collar off the end of the shaft.

b. Use a fine file to clean the burrs from around the pin hole in the shaft and remove the lower thrust washer.

c. Push the shaft up and remove it through the top of the distributor body. Remove the upper thrust washer.

d. Remove the shaft oiler and lift out the oiler wick.

CAUTION: Do not drive the bushings out of the housing.

e. Remove the upper bushing with Tool CA-3744 by threading the tap securely into the bushing. Place the spacer over the tap. Install the tool nut and, while holding the tap, tighten tool nut to remove the bushing. Invert the housing and remove the lower bushing in the same manner.

f. Soak the new bushings in light engine oil for approximately 15 minutes.

g. Position the new upper bushing with the hole in the bushing up and in line with the oil hole in the housing, then press the bushing into the distributor housing with Tool CA-3041 and the tool adaptor with the flat face of the adaptor contacting the bushing, press the bushing into the distributor until the top of bushing is 1.613 inches from top machined face of distributor housing. Place a straight-edge on the machined surface of housing and measure from bottom face of straight-edge to the top of the bushing. Invert the housing and install the other bushing flush with the face of the distributor base.

h. Insert a 3/32 inch rod through the housing oiler hole to see if the hole in the bushing indexes with the oiler hole in the housing.

If the rod cannot be inserted through the housing and the bushing, drill a 1/8" hole through the upper bushing by drilling through the oil wick hole. Remove burrs caused by the drilling operation.

i. Install the burnishing tool part of CA.3041 tool set and force the burnisher through both the bushings. The correct bushing inside diameter is .4995 to .5000 inch.

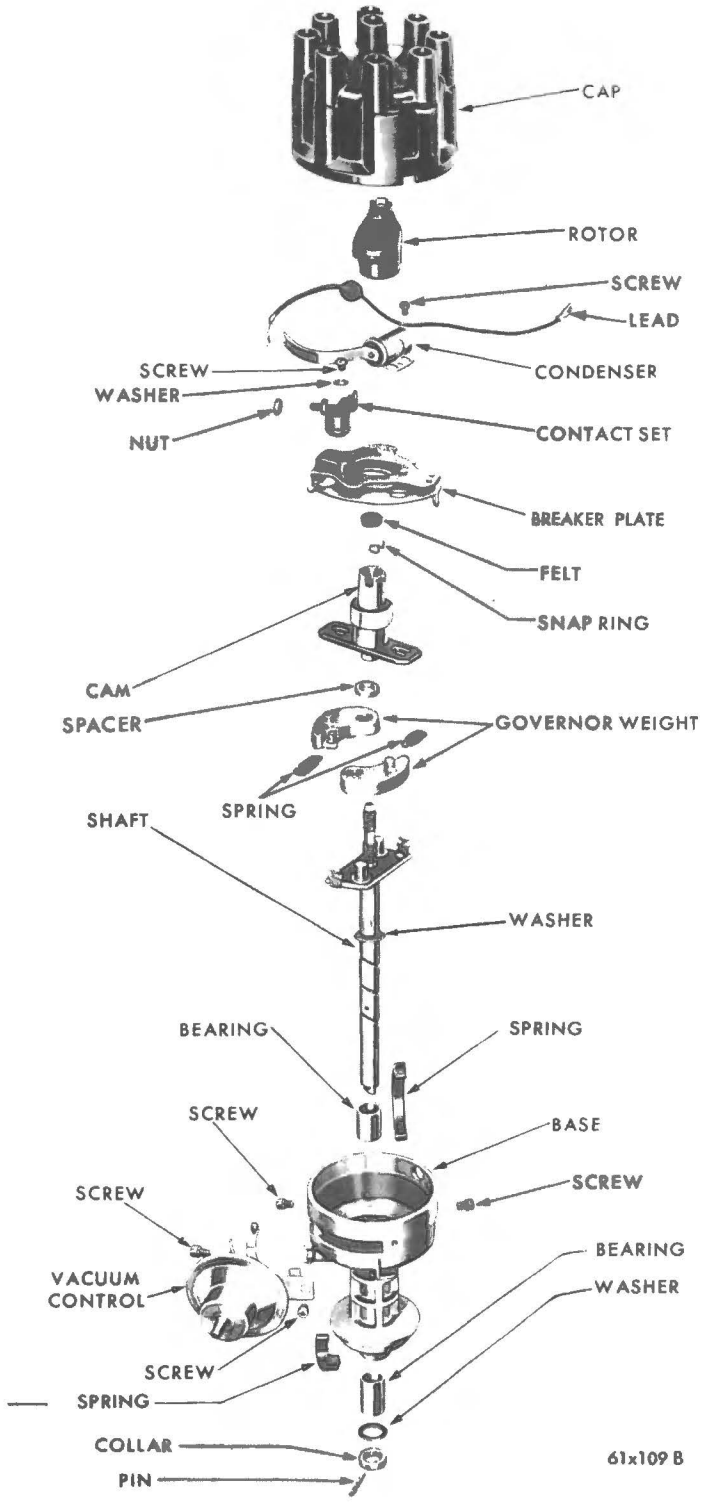


Fig. 5 Distributor (Exploded View)

2. ASSEMBLING

(1) Test operation of centrifugal weight and inspect the weight springs for distortion. Lubricate the governor weights.

(2) Inspect all bearing surfaces and pivot pins for roughness, binding or excessive looseness.

(3) Install the cam spacer, chamfered end down on the distributor shaft.

(4) Slide the cam and yoke on the distributor shaft, engage the weight lugs with the slots in the yoke. Install the cam retaining spring clip. Be sure it is properly seated in the groove of the distributor shaft.

(5) Lubricate and install the flat thrust washer. Position the washer on the distributor shaft and slide the shaft into the distributor body. Position the lower thrust washer and drive the collar on the lower end of the shaft. Install the retainer pin.

(6) Install the oiler wick and oiler.

(7) Install the contact plate assembly. Align the condenser lead, contact point spring, primary lead and install the attaching screw.

(8) Install the felt wick in the top of the distributor cam.

(9) Attach the vacuum advance unit arm to the contact plate and install the retainer. Install the vacuum unit attaching screws and washers.

(10) Test the contact arm spring tension, and adjust the contact gap.

(11) Lubricate the felt pad in the top of the distributor cam with 3 to 5 drops of light engine oil and install the rotor.

PART 5 — HORNS

SPECIFICATIONS

Number used:	2
Amperage Draw:	3.5 Amp.

SERVICE DIAGNOSIS

CONDITIONS — POSSIBLE CAUSES

1. HORNS WILL NOT BLOW

(1) Incorrect adjustment.
(2) Broken or defective wiring.
(3) Faulty horn.
(4) Defective horn ring switch.
(5) Low battery.

2. HORNS BLOW CONTINUOUSLY

(1) Shorted wiring.
(2) Grounded horn ring.

SERVICE INFORMATION PROCEDURES

1. GENERAL INFORMATION

The dual, matched horns have only one adjustment, which is accessible without any dismantling. This is the spring loaded contact point adjustment. The hexagon head of the adjustment screw projects from the rear cover opposite the terminal tab. Both horns are mounted on the right hand side panel.

2. TESTING HORNS

If horns are not operating test as follows:

Touch a jumper wire from relay "S" terminal to ground. If horn blows, fault is in horn button contact ring, or in wire from "S" terminal to horn button. If horn fails to blow, connect a jumper wire from "B" to

"H" terminal: If horns now operate, relay is defective. If horns fail to operate, fault is in wire to the horns, in the horns, or wire to horn relay "B" terminal.

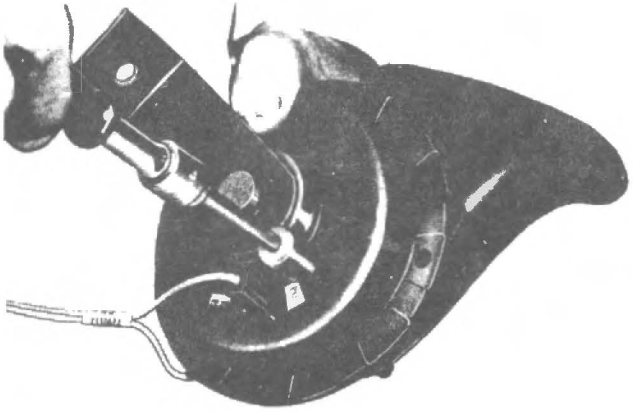


Fig. 1 - Adjusting horn (typical).

3. ADJUSTMENT

(1) Check battery for condition of charge.

(2) Check for loose or corroded connections in horn circuit. A loose connection, poor joint or bad contact at the horn button will cause the horn to operate intermittantly, and also affect the note.

(3) Check that horns are securely bolted to mounting.

(4) Check horn voltage by connecting a voltmeter across the horn terminals. When the horn is operating, the voltage never should be below 11 volts, a lower reading would indicate a high resistance in the horn circuit.

(5) Disconnect connection at each horn to determine which horn is not operating.

(6) Turn adjusting screw counter-clockwise until there is no vibration (sound).

(7) Turn adjusting screw clockwise, approximately $\frac{1}{4}$ turn at a time until the tone has a clear mellow sound. DO NOT turn adjusting screw whilst horn is blowing.

(8) If horn still does not operate, the contact points may require cleaning - to clean the points, remove the horn from the mounting (the bracket is permanently fixed to the horn body).

Remove the six screws around the periphery of the unit - (mark the position of the two halves before disassembly in order that the correct relationship will be maintained on re-assembly), separate the two halves to gain access to the points. Clean the points by passing a strip of crocus cloth backwards and forwards between them, wipe clean with a piece of clean linen.

Re-assemble horn and test.

Replace horn and make a final test with the engine running and the alternator charging.

The amperage draw when adjustment is correct should be 3.5 amps. Adjusting the screw clockwise increases amperage, and counter-clockwise decreases amperage.

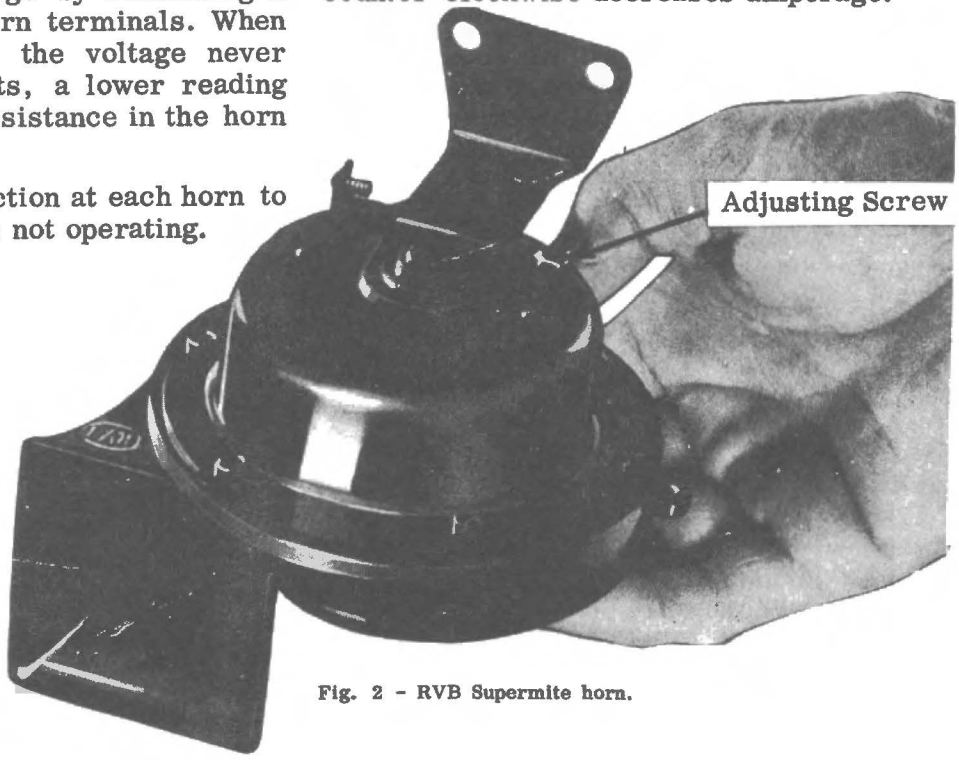


Fig. 2 - RVB Supermite horn.

PART 6 — WINDSHIELD WIPERS

SERVICE DIAGNOSIS
CONDITIONS — POSSIBLE CAUSES

1. WIPER OPERATES SLOWLY

(1) Binding linkage.

(2) High resistance in brush to commutator contact or carbon deposits in slots. Test armature commutator and brushes,

(3) Faulty control switch.

2. WIPER FAILS TO OPERATE

(1) Binding linkage.

(2) Faulty switch. (See Para. 14 for test procedure).

(3) Faulty motor.

(4) Open or grounded wiring.

(5) Blown fuse.

3. BLADES FOUL WINDSHIELD MOULDINGS

(1) Distorted or damaged wiper linkage.

4. BLADES CHATTER

(1) Twisted arm. DO NOT ATTEMPT TO STRAIGHTEN BENT OR TWISTED ARM.

(2) Wrong type blades used.

(3) Wax on glass.

SERVICE INFORMATION — PROCEDURES

1. GENERAL INFORMATION

The windshield wiper motor incorporates dual speed operation, providing satisfactory wiping operation for heavy or light rain. The parking switch is integral with the motor and gives satisfactory parking under all conditions, as the motor will always be on slow speed prior to the parking position being selected.

Consequently, this reduces the amount of over-run.

A three position switch on the instrument panel face covers both speeds "High" and "Low", and the "Parked" position.

As the windshield wiper assembly is pre-set during manufacture, there is no provision for adjustments. The parking position is also pre-determined and does not require adjustment.

2. WIPER MOTOR REMOVAL

(1) Disconnect the wiper link at the wiper motor.

(2) Disconnect the wiper motor lead wires at the wiper motor.

(3) Remove the three nuts attaching the wiper motor and bracket assembly to the cowl panel and pull the motor and bracket assembly down from the mounting studs and out from underneath the instrument panel.

3. DISASSEMBLY OF WIPER LINKS

(1) Remove the clip holding the drive link to the crank arm.

(2) Remove bevel washer and disconnect drive link (Fig. 1).

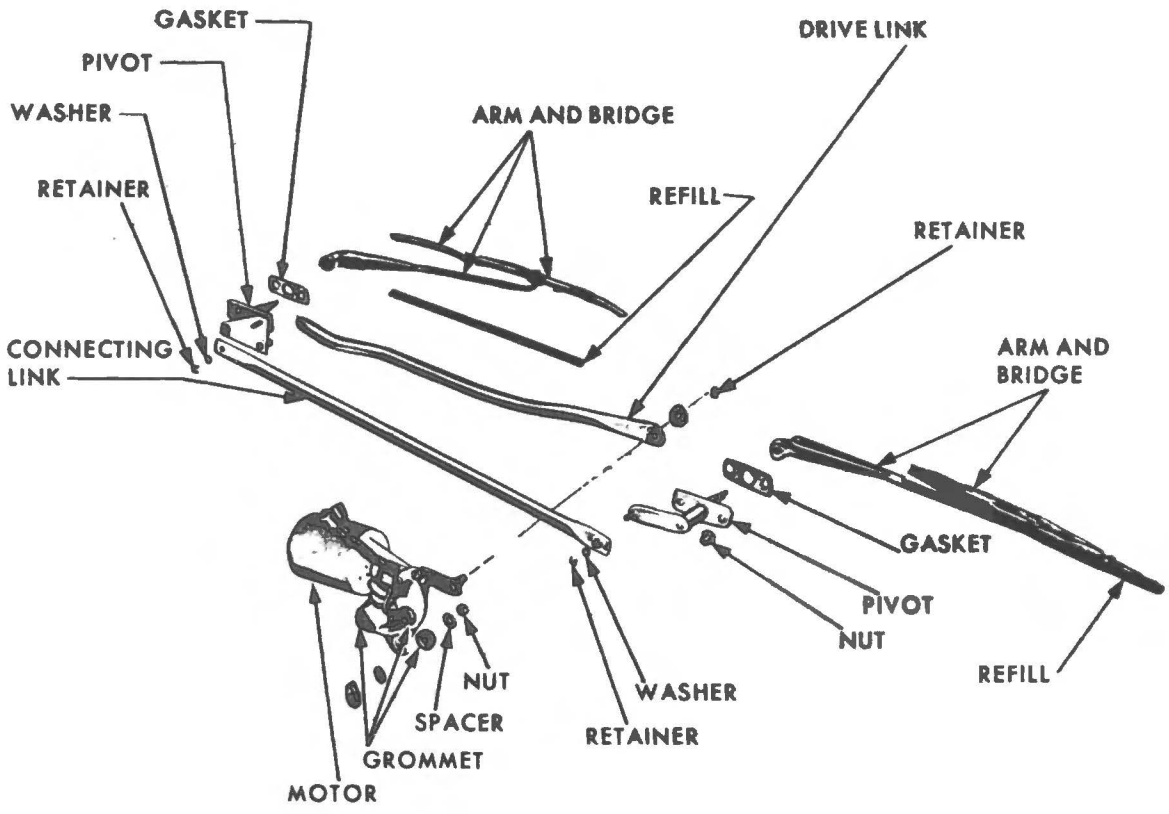


Fig. 1 - Windshield wiper (disassembled) (typical).

(3) Remove the connecting link by disconnecting the retainers and washers from the right and left pivot assemblies.

4. DISASSEMBLY OF WIPER MOTOR

(1) Remove the loom clip and gear case cover plate.

(2) Remove the motor crank nut, washer and motor crank arm.

(3) Lift out the fibre gear.

(4) Remove the end through bolts and carefully pull off the end plate.

(5) The armature can then be removed.

5. INSPECTION OF WIPER MOTOR

(1) Thoroughly inspect the motor parts for wear, corrosion or damage.

(2) Clean the armature commutator with 00 or 000 sandpaper or if necessary, turn down the commutator.

(3) Replace worn or oil soaked brushes.

(4) Check the armature and crankshaft in their respective bushings and replace worn parts if any looseness is detected.

(5) Inspect gear for worn or broken teeth and replace if showing damage or excessive wear.

6. REFACING THE COMMUTATOR

If the armature commutator is rough or out of round, burned, or the moulding material is even with, or extends above, the surface of the commutator bars, the commutator should be turned down.

Remove only enough metal to provide a clean, smooth surface. Operation can be performed on a suitable lathe or by using Tool C-770 (Fig. 2).

7. UNDERCUTTING THE SEGMENTS

Under-cut the moulded segments to a depth of 1/16" using Tool C-770 with special blade SP-839 (see Fig. 3). Be sure to

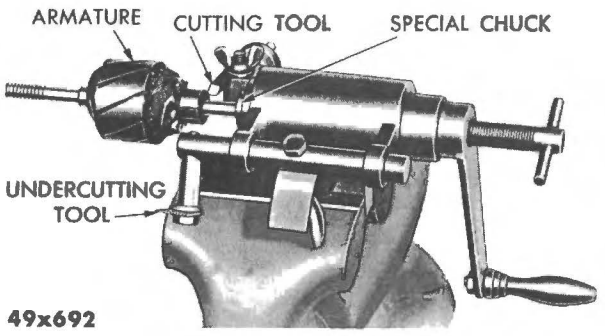


Fig. 2 - Re-facing commutator (typical).

undercut squarely. After undercutting, polish the commutator with 00 or 000 sandpaper to remove burred edges.

CAUTION: Be sure the commutator is clean and free from oil or grease. A dirty, greasy commutator will cause a high resistance and greatly impair the efficiency of the wiper.

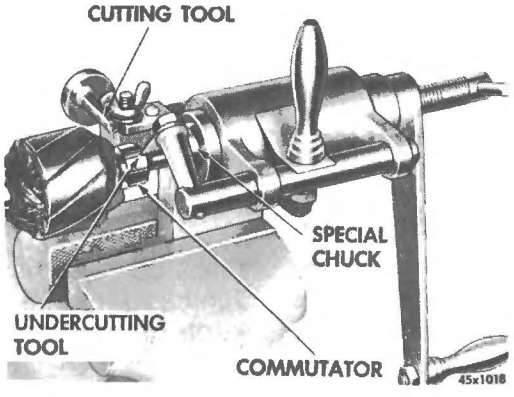


Fig. 3 - Undercutting moulded segments.

8. ASSEMBLING THE WIPER MOTOR

(1) Install the armature and the end plate. (Care should be taken to ensure that the brushes seat properly on the commutator).

(2) Install the through bolts and tighten securely.

(3) Install the fibre gear, crank arm, washer and nut and tighten securely. (Crank arm has a master spline).

NOTE: Make sure the gear teeth are adequately covered with long fibre grease.

(4) Replace the gear case cover plate and the loom clip and install the attaching screws.

9. END PLAY ADJUSTMENT

To adjust the armature shaft end play, turn adjustment screw in until it bottoms and back off one-quarter turn (Fig. 4) (lock by staking with centre punch).

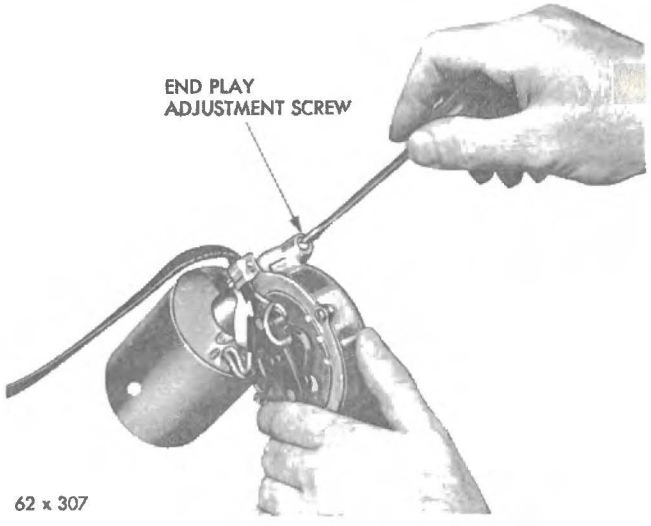


Fig. 4 - End play adjustment (typical).

10. BENCH TESTING WIPER MOTOR

Before bench testing the motor, the lead wires should be inspected for open or short circuits and for poor connections at the connectors. Connect the positive lead from a test battery to the "blue" terminal of the motor.

Connect one end of a test wire to the negative battery terminal, and, with the other end of the test wire, bridge the "green" and "red" terminals. The motor

should then operate at slow speed. With negative wire connected to the "green" terminal only, the motor should operate at fast speed.

11. ASSEMBLING THE WIPER LINKS

(1) Install the connecting link, washers and retaining clips to the right and left hand pivot assemblies (Fig. 1).

(2) Install the drive link to the left hand pivot crank.

12. WIPER MOTOR INSTALLATION

(1) Place the wiper motor and bracket assembly into position on the three mounting studs and install the attaching nuts and tighten securely.

(2) Connect the wiper motor lead wires.

(3) Connect the wiper drive link to the motor crank arm and install the washer and retaining clip.

13. REPLACING WIPER PIVOT

(1) Remove wiper arm.

(2) Disconnect the connecting link from the pivot.

(3) Remove the pivot attaching nuts and remove pivot and gasket.

(4) Install a new pivot and gasket and tighten the attaching nuts securely.

(5) Reconnect the connecting link to the pivot crank pin and install the washer and retainer clip.

(6) Install the wiper arm and blade.

14. WIPER SWITCH

To Remove

(1) Remove wiper switch control knob by removing the attaching screw with an Allen key.

(2) Remove the slotted retaining nut and the bezel from the switch, and pull the switch rearward and down from under the dash panel.

(3) Disconnect the lead wires from the switch.

To Test

(1) Connect a jumper wire from the switch body to the negative terminal of a 12V battery. Connect a testlight to the positive terminal of the battery.

(2) With switch in the first (slow) position test the terminals with the test lamp. The lamp should light on either terminal.

(3) With switch in the second (fast) position, test the terminals in a similar manner. The lamp should only light on the "green" terminal.

(4) With switch in the OFF position, the lamp should not light on either terminal.

(5) If the switch is faulty or inoperative, replace the switch. (The switch is serviced only as an assembly).

To Install

(1) Reconnect the lead wires to the switch, and place the switch into position in the dash panel.

(2) Replace the bezel and the retaining nut and tighten.

(3) Replace the wiper switch control knob and tighten the attaching screw.

PART 7 — GAUGES AND INSTRUMENTS

AP5 MODELS

SERVICE INFORMATION — PROCEDURES

1. GENERAL INFORMATION

The instrument cluster assembly is attached to the instrument panel by four cross-recessed screws. The cluster contains the speedometer, fuel gauge, temperature gauge, ammeter, oil pressure, warning light, high beam warning light, turn indicator warning light and ignition switch.

The instruments and lamps are attached to a printed circuit board in which are embedded the electrical circuits (conductors). The printed circuit completes the circuit to the fuel gauge, temperature gauge and instrument lamps.

The screws attaching the printed circuit to the cluster base serve as a ground for the instrument lamps.

With the exception of the leads to the ammeter, all wiring to the cluster is connected through a plug type multi-connector to the printed circuit male connector pins on the printed circuit board which is mounted to the back of the instrument cluster assembly. The female multi-connector is a push type with a master locator pin.

2. INSTRUMENT PANEL

To Remove

(1) Disconnect battery negative terminal.

(2) Disconnect speedometer cable (at rear of instrument panel).

(3) Remove the steering column support clamp from under the dash panel and allow column to drop slightly to permit removal of the instrument panel.

(4) Remove the four instrument panel attaching screws.

(5) Draw panel outwards and disconnect the multi-connector plug.

(6) Disconnect red and black wires from ammeter.

(7) Disconnect the ignition switch connector block.

(8) Remove instrument panel from dash panel.

> NOTE: To remove gauges from instrument panel, first remove the instrument panel bezel by removing the four attaching screws located at the rear of the panel (one in each corner). The gauges can then be removed separately, by removing the retaining nuts from the rear of the instrument panel.

To Install

(1) Replace gauges and instrument panel bezel (if removed).

(2) Position instrument panel above steering column and connect the ignition switch connector block, ammeter leads and multi-connector plug.

(3) Maneouvre the instrument panel into position and install the four instrument panel attaching screws and tighten evenly.

(4) Re-connect the speedometer drive cable.

(5) Replace the steering column support clamp and nuts and tighten securely.

(6) Re-connect the battery negative terminal.

(7) Check instruments, dash lights and speedometer for correct operation.

Instrument Panel Lights

All bulbs in the instrument panel are contained in plug-in sockets in the printed circuit. The bulbs can be reached from under the instrument panel. To remove the socket, turn in $\frac{1}{4}$ turn counter-clockwise and pull out.

3. TEMPERATURE GAUGE

The temperature gauge consists of two units. The dash unit situated in the instrument panel, and the thermo sender unit screwed into the cylinder block. One wire is used to connect the panel unit and sender unit.

If the temperature gauge is inoperative, or erratic, check all electrical connections at the dash unit and sender unit. Test the connecting wire for continuity or grounding by the use of a jumper lead between the dash unit and sender unit (disconnect connecting wire first).

If the above preliminary checks fail to locate the fault, test dash and sender units as follows:

To Test Sender and Dash Units

To make this test, procure a spare sender unit of known accuracy. Disconnect the wire from the sender unit in the cylinder block and connect it to the test sender unit. Use a jumper wire to earth the case.

Immerse the spare sender unit in hot water (in a container) and watch the dash unit gauge. If the condition has been rectified, the sender unit in the block should be replaced.

If the condition still exists when the spare sender unit is heated, then the dash unit should be replaced.

If a new dash unit was fitted in conjunction with the above test, and operation is still unsatisfactory when re-connected to the original sender unit, it indicates that both units were faulty before the test, and a new sender unit will also have to be fitted.

4. FUEL GAUGE

The fuel gauge consists of two units. The dash unit situated in the instrument panel, and the tank unit located in the petrol tank. One wire is used to connect the dash unit and tank unit.

The tank unit comprises a rheostat, the contact finger of which moves as the float rises and falls (according to the amount of fuel in the tank). The rheostat controls the needle movement by varying the resistance in the fuel gauge electrical circuit.

If the fuel gauge is inoperative, or erratic, check all electrical connections at the dash and tank units.

Check the tank unit for a good earth - check the fuel tank for a good earth. Test the connecting wire between the dash unit and the tank unit for continuity or grounds, by the use of a jumper lead (with connecting wire disconnected).

If the above preliminary checks fail to locate the fault, test the dash and tank units as follows:

To Test Tank and Dash Units

Procure a spare tank unit of similar type and of known accuracy.

(1) Disconnect the wire from the tank unit.

(2) Connect the wire to the test unit, and using a jumper wire, earth the case.

(3) Move the float arm of the spare tank unit up and down.

(4) If the dash unit registers in accordance with the movement of the float arm it indicates that the original tank unit is faulty and should be replaced.

(5) If the dash unit does not register correctly when float arm is moved, the dash unit is faulty and will have to be replaced.

5. SPEEDOMETER

To Remove

(1) Disconnect speedometer drive cable from speedometer head and remove instrument panel (refer Para. 2).

(2) Remove instrument panel bezel (refer Para. 2).

(3) Remove speedometer attaching nut and washer and remove the speedometer.

To Install

(1) Replace speedometer in the instrument panel and install the attaching nut and washer.

(2) Replace instrument panel bezel.

(3) Replace the instrument panel and reconnect the speedometer drive cable.

Speedometer Cable

Cable breakages may be caused by:-

(1) Kinked inner flexible cable.

(2) Distorted or damaged outer flexible casing.

(3) Speedometer head mechanism tight.

To Test Speedometer Head

Disconnect the flexible cable from the speedometer head. Take a short length (6 inches) of flexible cable with a tip to suit the speedometer head. Insert the test cable into the head and spin several times. If the cable tends to bind, then the speedometer head should be removed and serviced by an Authorised Speedometer Agent.

To Test Inner Flexible Cable

Remove the inner cable and lay on a flat surface. To check for any kinks, twist one end of the cable. If the cable turns over smoothly then it is not kinked. But, if any part of the cable flops over as it is twisted, then it is kinked and should be replaced.

Before inserting a new inner cable, check the outer casing for any distortion or breaks and replace if necessary. A wavering indicator needle is usually caused by a kinked flexible cable.

Installation of Flexible Cable

Take a clean piece of rag and add some cable lubricant to it. Holding the lubricant cover rag in the hand, pull the inner cable through it. By this means a fine film of lubricant will be deposited on the flexible cable. It is most important not to over lubricate the cable. Insert the inner cable into the outer casing. Use wide and gradual curves where the cable comes out of the transmission.

6. OIL PRESSURE INDICATING LAMP

The oil pressure indicating lamp is connected between the oil pressure sending unit on the oil filter and the ignition terminal of the ignition switch.

When the oil pressure exceeds 8 to 12 p. s. i. the contacts in the sending unit open and the indicator light goes out. If the oil pressure indicator is inoperative -

(1) Check the circuit for possible loose connections, broken wire or burned out globe.

(2) If the above checks fail to locate the fault, replace the oil pressure sending unit.

AP6 MODELS

SPECIAL TOOLS

CA-3826 Electronic Gauge Tester, Fuel, Temperature, Oil Gauge

SERVICE INFORMATION — PROCEDURES

1. GENERAL INFORMATION

The instrument cluster assembly is attached to the instrument panel by four cross-recessed screws. The cluster contains the speedometer, fuel gauge, temperature gauge, ammeter, oil pressure warning light and ignition switch.

The instruments and lamps are attached to a printed circuit board in which are embedded the electrical circuits (conductors). The printed circuit completes the circuit to the fuel gauge, temperature gauge and instrument lamps.

The screws attaching the printed circuit to the cluster base serve as a ground for the instrument lamps.

With the exception of the leads to the ammeter, all wiring to the cluster is connected through a plug type multi-connector to the printed circuit male connector pins on the printed circuit board which is mounted to the back of the instrument cluster assembly. The female multi-connector is a push type with a master locator pin.

2. INSTRUMENT PANEL

To Remove

(1) Disconnect battery negative terminal.

(2) Disconnect speedometer cable (at rear of instrument panel.

(3) Remove the steering column support clamp from under the dash panel and allow column to drop slightly to permit removal of the instrument panel.

(4) Remove the four instrument panel attaching screws.

(5) Draw panel outwards and disconnect the multi-connector plug.

(6) Disconnect red and black wires from ammeter.

(7) Disconnect the ignition switch connector block.

(8) Remove instrument panel from dash panel.

NOTE: To remove gauges from instrument panel, first remove the instrument panel bezel by removing the four attaching screws located at the rear of the panel (one in each corner). The gauges can then be removed separately, by removing the retaining nuts from the rear of the instrument panel.

To remove instrument voltage limiter from REAR of instrument panel unscrew the cross-recessed securing screw and lift limiter from panel. The two connecting leads (now visible) should be disconnected.

To Install

(1) Replace gauges, instrument voltage limiter and instrument panel bezel (if removed).

(2) Position instrument panel above steering column and connect the ignition switch connector block, ammeter leads and multi-connector plug.

(3) Manoeuvre the instrument panel into position and install the four instrument panel attaching screws and tighten evenly.

(4) Re-connect the speedometer drive cable.

(5) Replace the steering column support clamp and nuts and tighten securely.

(6) Re-connect the battery negative terminal.

(7) Check instruments, dash lights and speedometer for correct operation.

Instrument Panel Lights

All bulbs in the instrument panel are contained in plug-in sockets in the printed circuit. The bulbs can be reached from under the instrument panel. To remove the socket, turn it ¼ turn counter-clockwise and pull out.

3. INSTRUMENT VOLTAGE LIMITER

(a) Should there be a similarity in faults of both the temperature and fuel gauge indicator systems this is indicative of a faulty instrument voltage limiter e.g. low voltage output from instrument voltage limiter will cause both temperature and fuel indicators to read low.

(b) This unit is of a non-repairable nature and should be replaced with a new unit.

If there is still evidence of faulty indicator by either temperature or fuel indicators proceed with the following tests.

4. INSTRUMENT TESTING (WITHOUT ELECTRONIC TESTER CA-3826)

Temperature Gauge

The temperature gauge consists of two units. A thermal indicator unit situated in the instrument panel and the temperature transmitting unit screwed into the cylinder block. One wire is used to connect the panel unit and temperature transmitter.

> NOTE: With this type of equipment a "warm up" period of at least 30 seconds after switch on should be allowed before testing commences and/or readings are taken.

If the temperature gauge is inoperative, or erratic, check all electrical connections at the dash unit and temperature transmitter.

Test the connecting wire for continuity or grounding by the use of a jumper lead between the dash unit and temperature transmitter (disconnect connecting wire first).

If the above preliminary checks fails to locate the fault, test dash and temperature transmitter as follows:

To Test Transmitter and Dash Units

To make this test, procure a spare temperature transmitter of known accuracy. Disconnect the wire from the temperature transmitter in the cylinder block and connect it to the test temperature transmitter. Use a jumper wire to earth the case.

Immerse the spare temperature transmitter in hot water (in a container) and watch the dash unit gauge. If the condition has been rectified, the temperature transmitter in the block should be replaced.

If the condition still exists when the spare temperature transmitter is heated, then the dash unit should be replaced.

If a new dash unit was fitted in conjunction with the above test, and operation is still unsatisfactory when re-connected to the original temperature transmitter, it indicates that both units were faulty before the test, and a new temperature transmitter will also have to be fitted.

Fuel Gauge

The fuel gauge system consists of two units. The thermal indicator unit situated in the instrument panel and the tank unit located in the petrol tank. One wire is used to connect the panel indicator and the tank unit.

The tank unit comprises of a rheostat, the contact finger of which moves as the float rises and falls (according to the amount of fuel in the tank). The rheostat controls the needle movement by varying

the resistance in the fuel gauge electrical circuit.

If the fuel gauge is inoperative, or erratic, check all electrical connections at the dash and tank units.

Check the tank unit for a good earth-check the fuel tank for a good earth. Test the connecting wire between the dash unit and the tank unit for continuity or grounds, by the use of a jumper lead (with connecting wire disconnected).

If the above preliminary checks fail to locate the fault, test the dash and tank units as follows:

To Test Tank and Dash Units

Procure a spare tank unit of similar type and of known accuracy.

(1) Disconnect the wire from the tank unit.

(2) Connect the wire to the test unit, and using a jumper wire, earth the case.

(3) Move the float arm of the spare tank unit VERY SLOWLY from the empty to full position and vice versa.

(4) If the dash unit registers in accordance with the movement of the float arm it indicates that the original tank unit is faulty and should be replaced.

(5) If the dash unit does not register correctly when float arm is moved, the dash unit is faulty and will have to be replaced.

Testing Oil Pressure Indicating Lamp

The oil pressure indicating lamp is connected between the oil pressure transmitter on the oil filter and the ignition terminal on the ignition switch.

When the oil pressure exceeds 8 to 12 p.s.i. the contacts in the transmitter open and the indicator light goes out. If the oil pressure indicator is inoperative -

(1) Check the circuit for possible loose connections, broken wire or burned out globe.

(2) If the above checks fail to locate the fault, replace the oil pressure transmitter.

5. INSTRUMENT TESTING (WITH ELECTRONIC TESTER CA-3826)

The fuel, temperature and oil gauges may be tested for operation and accuracy with electronic tester (Tool CA-3826). Tests of the gauges sending units, loose connections, resistance and broken wiring may be made with the electronic tester and the ammeter may be tested with a conventional ammeter-voltmeter tester.

> CAUTION: Do not connect full battery voltage directly to the gauges.

The thermal gauges operate on approximately 5 volts, and a voltage limiter is used to reduce the battery voltage from 12 to 5 volts. As a safety precaution the battery negative ground cable should always be removed from the battery before attempting any corrective work that pertains to gauges and switches in the instrument panel.

Temperature Gauge

(1) Disconnect the wire from the temperature sending unit on the engine.

(2) Connect one test lead of tester Tool CA-3826 on the terminal and the other test lead to a good ground.

(3) Place the pointer of the gauge tester on the L position and turn the ignition switch to ON. The temperature gauge should show C $\pm \frac{1}{8}$".

> NOTE: Thermal gauges are slow in operation. Allow time for gauge to heat up.

(4) Place the pointer on the tester to the M position and the temperature gauge should advance to the driving range or half position of the dial.

(5) Place the pointer of the tester in the H position and the gauge should advance to the H position of the dial.

Should the gauge respond to the above tests but not operate when wire and clip are attached to the sending unit, indications are of a defective sending unit which should be replaced. Should the gauge fail to respond to these tests, indications are of possible loose connections, broken wire or faulty gauge. The instrument cluster should be removed for further inspection.

Fuel Gauge

(1) Raise car on lift.

(2) Disconnect gauge lead wire from tank unit.

(3) Attach one lead of the gauge tester to connector leading to the dash unit. Connect the other lead of the tester to a good ground. With the ignition switch turned on and the gauge tester in the L position, the fuel gauge should show E, plus or minus 3/32".

NOTE: This tolerance permits a small reserve of fuel at the E position.

With the gauge tester in the M position, the fuel gauge should slowly advance to the half position, plus or minus 1/16". With the gauge tester in the H position the fuel gauge should advance to F, plus or minus 3/32".

Should the gauge respond to the above tests using the CA-3826 Tester, but not respond when the wire is connected to the tank unit, the trouble is in the tank unit. If the gauge does not respond to tests, indications are of possible loose connections, broken wire, or a defective fuel gauge. The instrument cluster should be removed for further inspection.

Oil Pressure Indicator Lamp

To test the oil pressure warning light.

(1) Remove the wire from the oil pressure sending unit.

(2) Connect one lead of the CA-3826 tester to the terminal and the other test lead to a good ground.

With the ignition switch in the ON position and the gauge tester in the L position the indicator light should just light. With the gauge tester in the M position, the indicator light should show a brighter glow. With the gauge tester in the H position, the indicator light should show full brilliance.

Should the oil pressure warning light fail to respond to the above tests, indications are of possible loose connections, broken wire or a burned-out bulb.

6. SPEEDOMETER

To Remove

(1) Disconnect speedometer drive cable from speedometer head and remove instrument panel. (Refer para. 2).

(2) Remove instrument panel bezel (Refer para. 2).

(3) Remove speedometer attaching screws (2) eyelets and grommets and carefully lift speedometer from panel.

To Install

(1) Replace speedometer in the instrument panel and secure by using screws, eyelets grommets.

(2) Replace instrument panel bezel.

(3) Replace the instrument panel and reconnect the speedometer drive cable.

Speedometer Cable

Cable breakages may be caused by:-

(1) Kinked inner flexible cable.

(2) Distorted or damaged outer flexible casing.

(3) Speedometer head mechanism tight.

To Test Speedometer Head

Disconnect the flexible cable from speedometer head. Take a short length (6 inches) of flexible cable with a tip to suit the speedometer head. Insert the test cable into the head and spin several times. If the cable tends to bind, then the speedometer head should be removed and serviced.

To Test Inner Flexible Cable

Remove the inner cable and lay on a flat surface. To check for any kinks, twist one end of the cable. If the cable turns over smoothly then it is not kinked. But, if any part of the cable flops over as it is twisted, then it is kinked and should be replaced.

Before inserting a new inner cable, check the outer casing for any distortion or breaks and replace if necessary. A wavering indicator needle is usually caused by a kinked flexible cable.

Installation of Flexible Cable

Take a clean piece of rag and add some cable lubricant to it. Holding the lubricant cover rag in the hand, pull the inner cable through it. By this means a fine film of lubricant will be deposited on the flexible cable. It is most important not to over lubricate the cable. Insert the inner cable into the outer casing. Use wide and gradual curves where the cable comes out of the transmission.

PART 8 — HEADLAMPS

SPECIAL TOOLS

Model 130 - Hoppy Split-Image Lev - L - Lite

SERVICE INFORMATION — PROCEDURES

1. GENERAL INFORMATION

The headlamp system consists of two sealed beam 2 filament headlamps mounted in the front fenders. Vertical and horizontal adjustments are provided for the purpose of aiming.

NOTE: When aiming the headlamps on utility models allowance must be made for different loading conditions the vehicle is likely to meet in service. It is recommended that adjustments be made with the utility subject to the load representative of the average loading conditions under which the vehicle will be operating. Due regard must be given to any special State law regarding headlamp aiming and any special variations called for should be complied with.

2. AIMING THE HEADLAMPS (WITH AIMERS)

Pre-Aiming Procedure

(1) Before adjustment, the suspension height and tyre pressure should be checked and adjusted if necessary.

(2) Check dipper switch for faulty operation.

(3) Check high beam indicator for correct operation.

(4) Check for badly rusted or faulty headlamp assemblies. These must be corrected before a satisfactory adjustment can be made.

(5) Place vehicle on a level floor.

(6) Rock vehicle to allow vehicle to assume its normal position.

(7) If petrol tank is not full, place a weight in the boot of vehicle to simulate the weight of a full tank ($7\frac{1}{4}$ lb. per gallon). There should be no other load in the vehicle other than the driver or a substituted weight of approximately 150 lb. placed in the driver's position.

(8) Remove headlamp door. Do not remove the sealed beam retainer rim.

(9) Thoroughly clean headlamp lenses.

(10) Check aimer calibration.

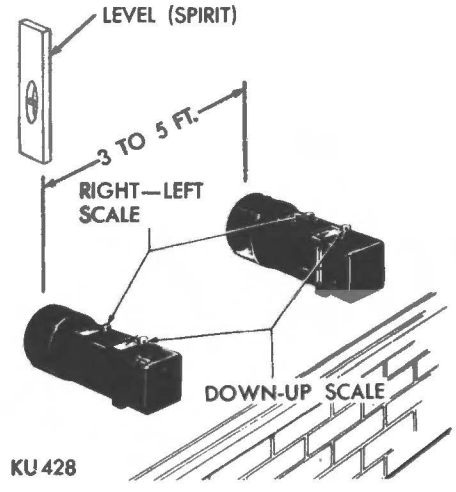


Fig. 1 - Checking aimer for calibration.

To Check Aimer for Calibration

(1) Using a carpenter or stone mason level of known accuracy, locate a true vertical plate glass window or smooth surface.

(2) Set DOWN-UP pointer on DOWN 2.

(3) Set RIGHT-LEFT pointer and floor level compensator at 0.

(4) Secure aimers to glass or smooth surface 3 feet to 5 feet apart so split image targets can be located in the viewing ports.

(5) If bubble is centred in glass dial, vertical calibration is correct. If bubble is not centred, make the DOWN-UP adjustment by rotating the level adjusting screw until the bubble is centred in the spirit level.

(6) The horizontal aim is correct if the targets on opposite aimers are aligned in viewing ports. If targets are not aligned in viewing ports, rotate mirror adjusting screw until target split image becomes aligned.

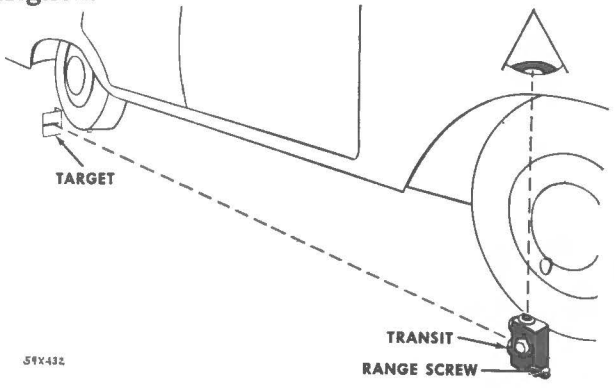


Fig. 2 - Determining slope of floor (typical).

To Compensate and Mount the Aimers

(1) For mechanical aim, the slope of the floor should be known.

(2) Place transit on floor in line with vertical centreline of the right front wheel (Fig. 2). Place split image target in like position at right rear wheel.

(3) Adjust range screw on transit until target split image coincides or merges into one unbroken line.

NOTE: Make sure that line of sight is perpendicular from the eye to the viewing port of the transit and that target image is centred in viewing port of transit.

(4) Turn dial on side of transit until bubble in spirit level is centred.

(5) When bubble is centred, note plus or minus reading on compensator scale. This figure indicates the degree of slope of the floor and must be transferred to each aimer.

(6) With a screwdriver, turn adjusting slot of floor level compensator in each aimer, until the correct plus or minus figure (or fractional part) appears in the correct window (Fig. 4).

Fig. 3 - Adjusting floor level compensators.

To Mount and Adjust the Aimers

(1) Whilst holding an aimer in alignment with the lens of one headlamp, bring aimer up to and against headlamp lens.

NOTE: Make certain that the headlamp lens pads are making full contact with the aimer mounting flange and that the aimer target is facing inboard.

(2) Push the release lever forward (to expel air from suction cup) and whilst holding the aimer firmly against the headlight aiming pads, slowly pull the release lever back until the spring lock engages in the slot.

(3) Mount the second aimer on the other headlamp in the same manner.

(4) On each aimer, set pointer to numeral 2 on the DOWN side of the DOWN-UP scale.

(5) On each aimer, position the pointer of the RIGHT-LEFT scale, at 2 - LEFT.

To Check Horizontal Aim

Turn the RIGHT-LEFT scale knob until the split image is in alignment. If the RIGHT or LEFT portion of scale exceeds the following values, the lamp should be aimed.

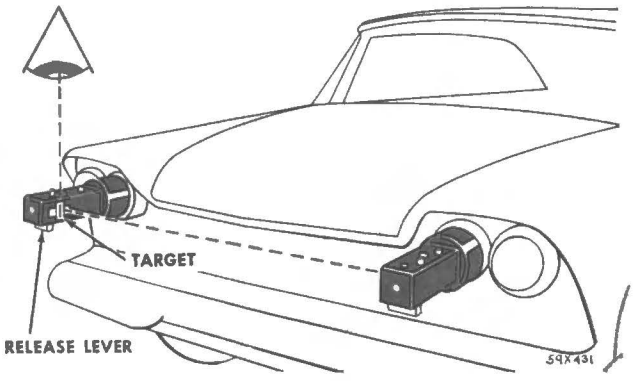


Fig. 4 - Mounting and adjusting aimers (typical).

Values given represent inches at 25 ft. :

RIGHT	0
LEFT	4

To Check Vertical Aim

Turn DOWN-UP scale knob until the spirit level is centred. If DOWN or UP portion of the scale exceeds the following values, the lamps should be aimed.

DOWN	$\frac{1}{2}-3\frac{1}{2}$
UP	0

To Make Horizontal Adjustment

(1) With the pointer of RIGHT-LEFT scale still set at 2 - LEFT, sight through the aimer viewing port.

NOTE: Make sure that the line of sight is perpendicular from the eye to the viewing port of the aimer and that the target image is centred in the viewing port of the aimer.

(2) Whilst sighting through the viewing port of the aimer, turn the horizontal adjusting screw on the headlamp until the split image target line merges into one unbroken line. To remove backlash, be sure to make a final adjustment by turning headlamp horizontal adjusting screw in a clockwise direction.

(3) Make the horizontal adjustment on the other headlamp in the same manner.

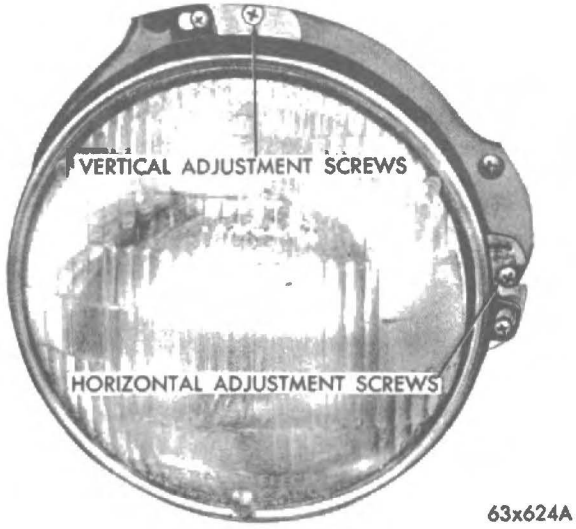


Fig. 5 - Headlamp adjustments (typical).

To Make Vertical Adjustment

(1) Turn vertical adjusting screw on headlamp in a counter-clockwise direction to bring the bubble of the spirit level on the aimer to car side of centre. Use care to avoid disturbing the installed position of the aimers. Then turn the screw clockwise until the bubble is centred for correct aim and elimination of backlash.

(2) Make the vertical adjustment on the other headlamp unit in the same manner.

(3) Recheck the target alignment on each side and readjust the horizontal aim, if necessary.

(4) Install headlamp door.

NOTE: Remove the aimers by releasing the spring lock at the rear (bottom) of the aimer and pushing the release lever forward. Do not attempt to remove the aimers by pulling them away from the headlamp lens - Slide the suction cup downward and away from the lens.

3. AIMING THE HEADLAMPS (WITH AIMING SCREEN)

The following is an alternative method of aiming the headlamps if aimers are not available.

To aim the headlamps, use an aiming screen, or a light-coloured wall as shown in Fig. 6. The vertical dimension to the horizontal line should be equal to the height of the headlamps above the ground less 1 inch for the particular car being checked. This is to make allowance for suspension height variations.

(1) Place the car on a level floor, 25 feet from the aiming screen, and directly in line with the centre line of the screen.

(2) Jounce the vehicle, first in the front end and then in the rear, to ensure the vehicle is in normal position.

NOTE: The vehicle should contain no passengers, driver or trunk load, and the vehicle should have a full tank of petrol.

(3) With the headlamps on high beam, adjust the lights so that the centre of the beam coincides with the intersection of the horizontal and vertical lines shown in Fig. 6.

4. HEADLAMP SEALED BEAM REPLACEMENT

Lens, filament and reflector are sealed into one unit which can be removed as follows:

(1) Remove the screws from the headlamp door and remove the door.

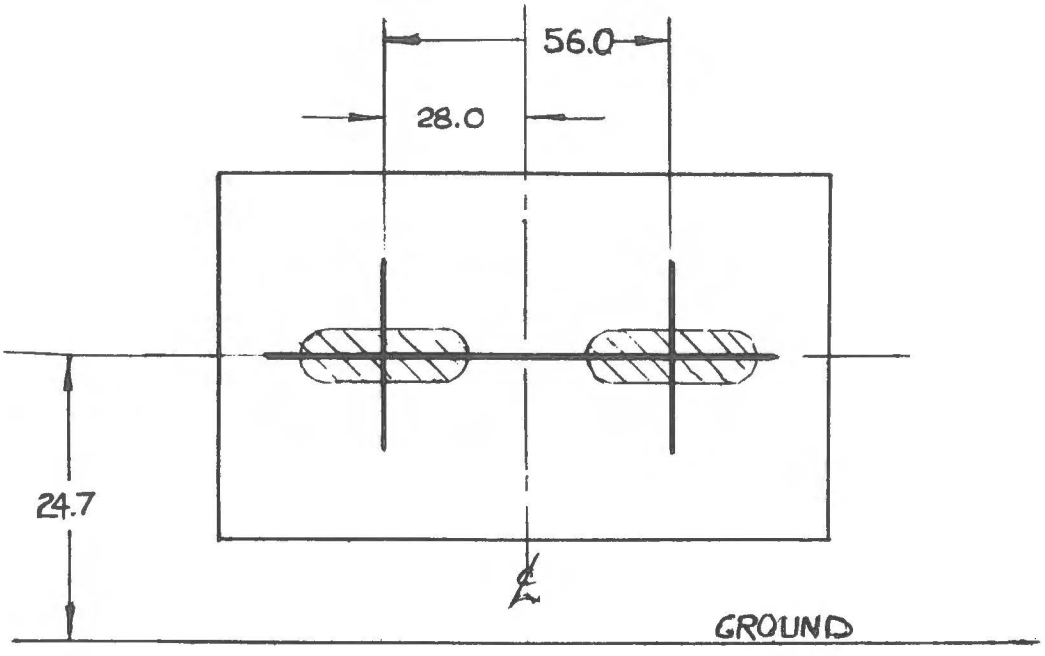


Fig. 6 - Pattern for high beam aiming.

(2) Remove the screws from the interior retaining ring and remove the ring.

NOTE: Do not disturb the headlight aiming screws.

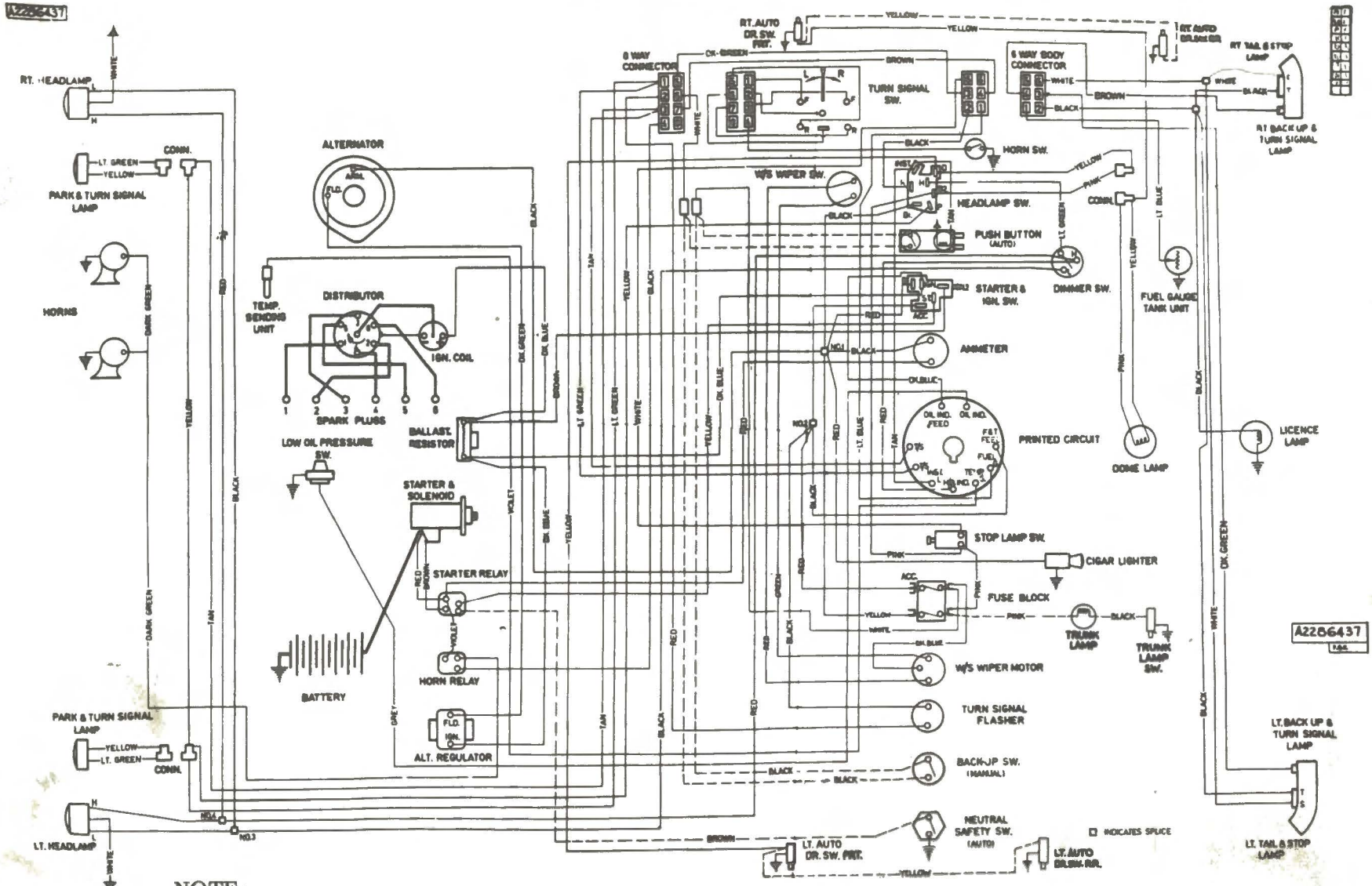
(3) Pull out the sealed beam unit and unplug the connector.

(4) Install new sealed beam unit.

(5) Install unit retaining ring and headlamp door.

(6) Re-check headlamp aiming if necessary.

AP5 WIRING DIAGRAM



NOTE:

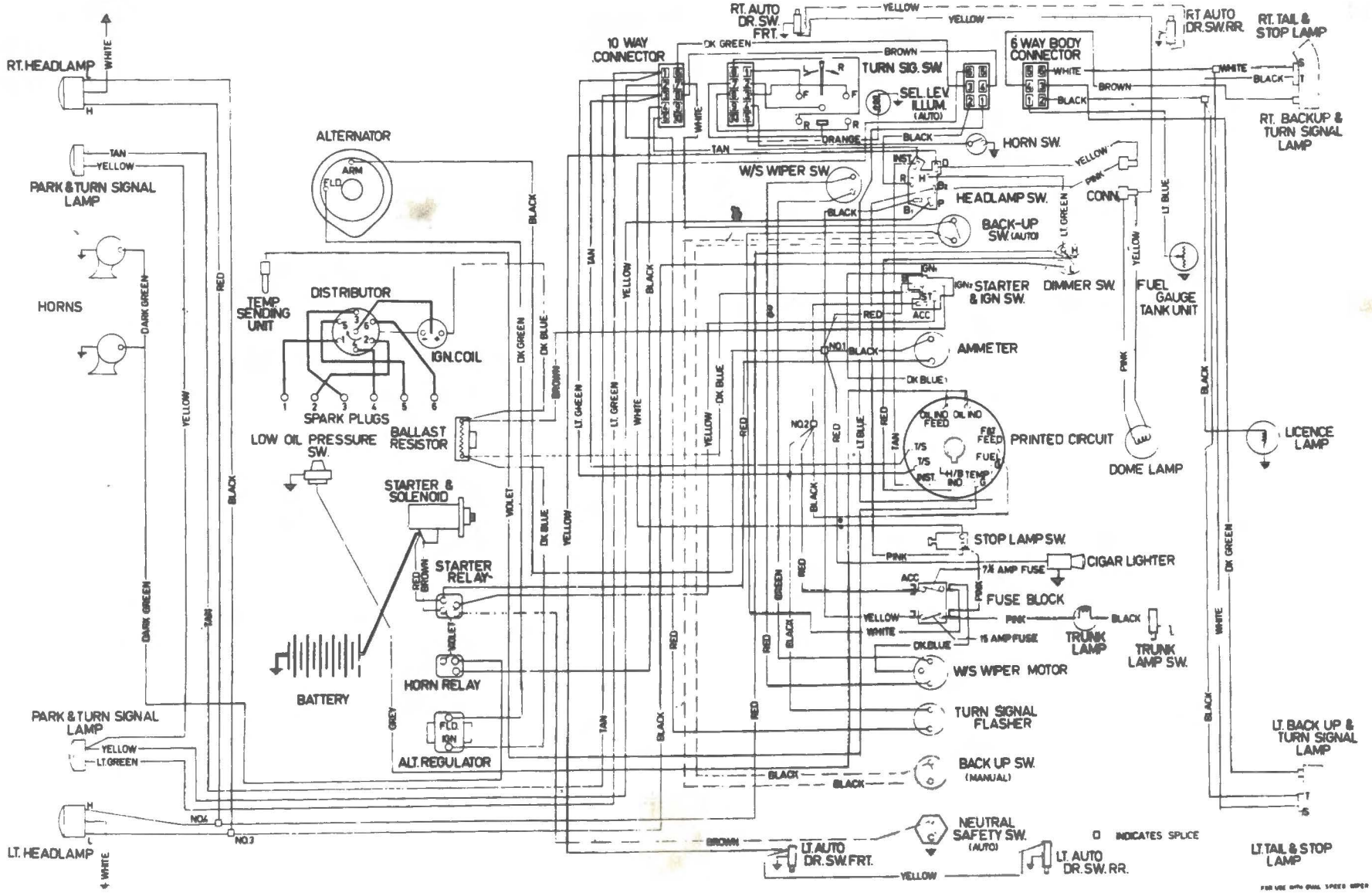
(A) Vehicles fitted with single speed windshield wipers both fuses - 15 amp.

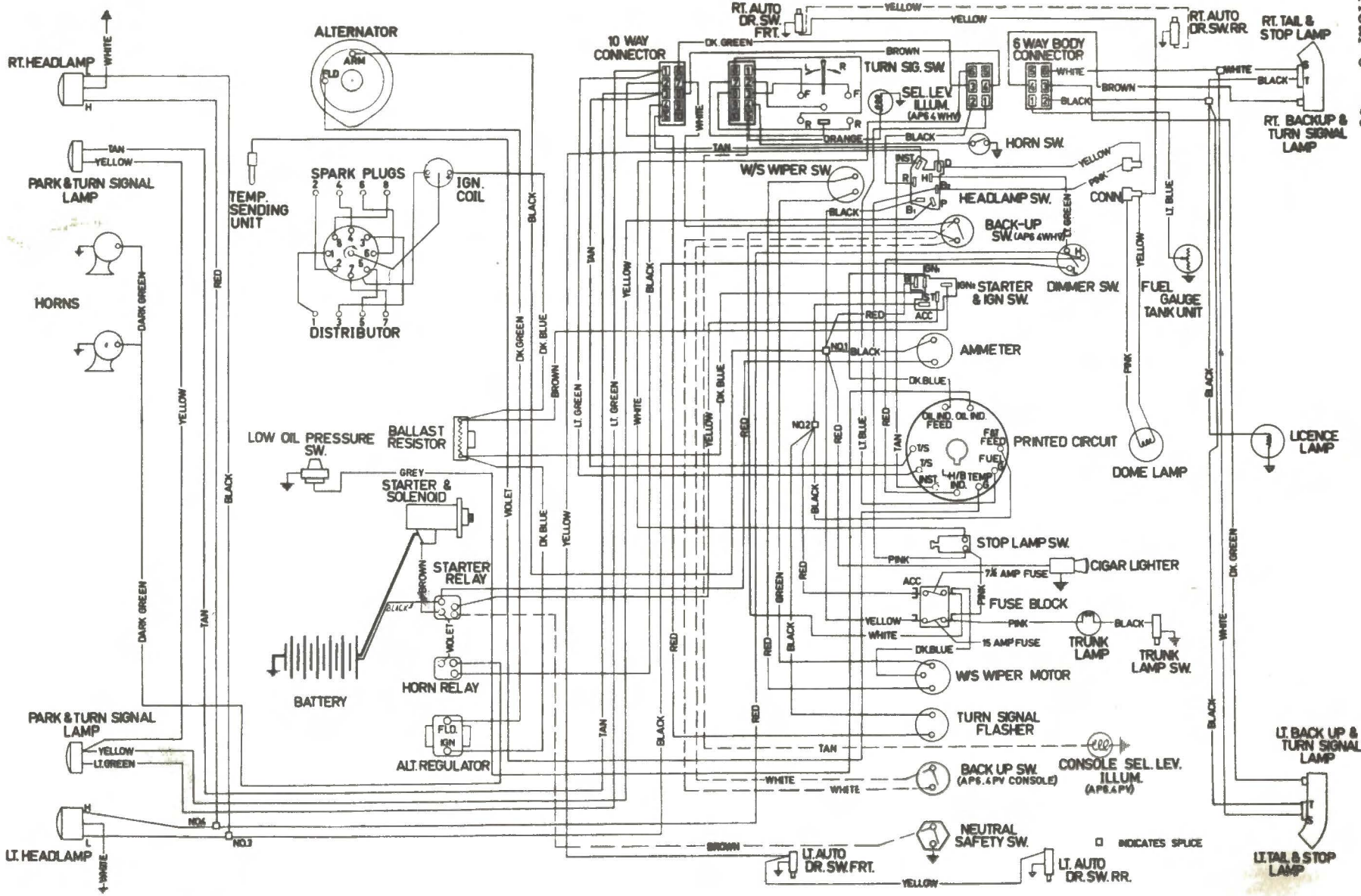
(B) Vehicles fitted with dual speed windshield wipers.

(1) Trunk lamp circuit - 15 amp. fuse.

(2) Windshield wiper circuit and back-up light circuit - $7\frac{1}{2}$ amp. fuse.

AP6 WIRING DIAGRAM





AP6-4PV AND 4 WHV
WIRING DIAGRAM

GROUP 9
ENGINE
6 CYLINDER

PART 4 ENGINE OILING SYSTEM

SERVICE BULLETIN REFERENCE

Date	Number	Subject	Changes

SERVICE DIAGNOSIS

CONDITIONS — POSSIBLE CAUSES

1. ENGINE WILL NOT START — NORMAL CRANKING

(1) Dirty or corroded distributor points.

(2) Carburettor flooded.

(3) Moisture on ignition wires and distributor cap.

(4) Dirt or water in the fuel line or carburettor.

(5) Incorrect spark plug gaps.

(6) Faulty coil or condenser.

(7) Faulty ignition cables.

(8) Vapour lock.

(9) Faulty fuel pump.

(10) Incorrect timing (ignition).

(11) Shorted out pigtail lead on distributor.

2. ENGINE WILL NOT START — (WEAK, SLOW OR ERRATIC CRANKING)

(1) Weak battery.

(2) Faulty starter solenoid.

(3) Faulty starting motor.

3. ENGINE STALLS

(1) Idle speed set too low.

(2) Idle mixture too lean or too rich.

(3) Improper choke adjustment.

(4) Incorrect carburettor float setting.

(5) Faulty coil or condenser.

(6) Valve lash below specified setting.

(7) Leak in intake manifold. (Check intake manifold gasket).

4. ENGINE MISSES WHILST IDLING

(1) Dirty or incorrectly gapped spark plugs.

(2) Burned or pitted contact points.

(3) Broken or loose ignition wires.

(4) Incorrect carburettor idle adjustment.

(5) Burned, cracked distributor rotor.

(6) Moisture on ignition wires, distributor cap or spark plugs.

(7) Distributor cap cracked.

(8) Weak battery.

(9) Incorrect carburettor float level.

(10) Faulty coil or condenser.

(11) Excessive play in distributor shaft.

(12) Burned, warped or pitted valves.

5. ENGINE MISSES ON ACCELLERATION

(1) Distributor contact points dirty or incorrectly gapped.

(2) Spark plugs dirty or set too wide.

(3) Dirt in carburettor.

(4) Accellerating pump in carburettor not operating correctly.

(5) Coil or condenser defective.

(6) Incorrect ignition timing.

(7) Burned, warped, or pitted valves.

6. ENGINE MISSES AT HIGH SPEED

(1) Distributor contact points dirty or incorrectly gapped.

(2) Spark plugs dirty or gap set too wide.

(3) Dirt or water in fuel line of carburettor.

(4) Burned, cracked distributor rotor.

(5) Defective coil or condenser.

(6) Dirty jets in carburettor.

(7) Incorrect ignition timing.

(8) Excessive play in distributor shaft.

(9) Distributor shaft cam worn.

7. ENGINE HAS LOSS OF POWER

(1) Dirty or incorrectly gapped spark plugs.

(2) Dirt or water in fuel line or carburettor.

(3) Incorrect ignition timing.

(4) Incorrect carburettor float level.

(5) Defective fuel pump.

(6) Incorrect valve tappet lash.

(7) Incorrect mechanical or vacuum advance (distributor).

(8) Plugged or restricted muffler or tail pipe.

(9) Defective coil or condenser.

(10) Distributor rotor burned or cracked.

(11) Excessive play in distributor shaft.

(12) Worn distributor cam.

(13) Incorrect valve timing.

(14) Burned, warped or pitted valves.

(15) Blown cylinder head gasket.

(16) Low compression.

8. NOISY VALVES

(1) Excessive lash.

(2) Excessive runout or valve seat or valve face.

(3) Broken or cocked springs.

(4) Worn valve guides.

(5) Worn tappets.

9. CONNECTING ROD BEARING NOISE

(1) Low oil pressure.

(2) Insufficient oil supply. (Inspect oil pump relief valve and spring).

(3) Thin or diluted oil.

(4) Excessive bearing clearance.

(5) Connecting rod journals out-of-round.

(6) Misaligned connecting rods.

10. MAIN BEARING NOISE

(1) Loose vibration damper or crank pulley.

(2) Low oil pressure.

(3) Insufficient oil supply.

(4) Excessive bearing clearance.

(5) Loose flywheel or torque converter.

(6) Excessive end play.

(7) Crankshaft journals out-of-round.

11. EXCESSIVE OIL CONSUMPTION

(1) Oil leaks.

(2) Cracked valve stem oil shields.

(3) Excessive valve guide to stem clearance.

(4) Worn, scuffed or broken rings.

(5) Rings tight, or stuck in grooves.

(6) Excessive side clearance between rings and grooves.

(7) Compression rings installed upside down.

(8) Clogged oil ring slots.

(9) Excessive cylinder bore taper and/or out-of-round.

(10) Improper seating of rings during break-in.

(11) Incorrect cylinder bore honing.

(12) Cylinder head oil drain-back holes clogged.

12. OIL PRESSURE DROP

(1) Low oil level.

(2) Thin or diluted oil.

(3) Oil pump relief valve stuck.

(4) Excessive bearing clearance.

(5) Worn parts in oil pump.

(6) Oil pump suction tube not aligned or bent.

(7) Air leak into oiling system.

PART I ENGINE TUNE-UP

SERVICE INFORMATION PROCEDURES

1. GENERAL INFORMATION

Engine tune-up, one of the most important of the maintenance services, determines whether or not the car will perform with maximum economy and efficiency. With the higher compression ratios, improved electrical and fuel systems and other advances in design, todays engines have become more sensitive to usage and operating conditions, all of which have a decided effect on power and performance. It is therefore important that this service be performed on the engine every spring and autumn, or more often if conditions warrant.

The following paragraphs outline in general the tune-up procedures. Also, specifications are included for the subject wherever possible. In some paragraphs the specifications are included in the procedures.

2. COMPRESSION TEST

An engine without reasonably high and uniform compression cannot be effectively tuned. The compression of each cylinder should be tested before any other tune-up operations are performed. The engine must be at operating temperature when performing the compression test.

NOTE: Measure valve tappet clearance to ensure there is sufficient clearance before performing the compression test.

Compression pressure with engine warm, spark plugs removed, wide open throttle at minimum cranking speed of 130 r.p.m. - 110 - 140 p.s.i.

Maximum variation between cylinders - 20 p.s.i.

(1) Remove any foreign matter from around spark plugs by blowing out plug area with compressed air, then loosen all plugs one turn.

(2) Start the engine and accellerate to 1000 r.p.m. to blow out loosened carbon. Stop engine and remove plugs note cylinder from which each plug was removed for future reference.

NOTE: Clearing out carbon in this manner is important in preventing false compression readings due to particles of carbon becoming lodged under the valves.

(3) Remove air cleaner and block throttle and choke in wide-open position.

(4) Connect remote control starter switch to the starter solenoid.

(5) Insert the compression gauge firmly in spark plug opening, and crank engine through at least four compression strokes to obtain highest possible reading.

(6) Test and record compression of each cylinder. Compression should read within the limits indicated in the specifications.

(7) If one or more cylinders read low or uneven, inject about a tablespoon ot engine oil on top of pistons in low reading cylinders. Crank engine several times and re-check compression. If compression comes up but does not reach normal, rings are worn. If compression does not improve, valves are sticking or seating poorly. If two adjacent cylinders show low compression, and injecting oil does not improve condition, the cause may be a head gasket leak between the cylinders.

3. VALVE CLEARANCE ADJUSTMENT

An engine will not perform efficiently if the valve clearance is not properly adjusted. Also it might cause low readings during compression test.

Valve Clearance

Intake	Exhaust
.010"	.020"

(1) Warm up the engine to normal operating temperature, then remove the cylinder head cover.

(2) With engine running at idle speed, insert feeler gauge of correct thickness between end of valve stem and rocker arm. Adjust the self-locking rocker arm screw until there is a slight drag on the feeler gauge.

(3) The screw should have a minimum of 3 pounds/feet tension as it is turned. If less than this, replace the adjustment screw, and if necessary, the rocker arm.

4 IGNITION SYSTEM

Spark Plugs

(1) Remove the spark plugs. Examine firing ends of plugs for evidence of oil fouling, gas fouling, burned or over-heating conditions. Oil fouling is usually identified by wet, sludgy deposits caused by excessive oil consumption. Gas fouling is usually identified by dry, black fluffy deposits, caused by incomplete combustion. Burned or overheated spark plugs are usually identified by a white burned or blistered insulator nose, and badly burned electrodes. Incorrect fuel, inefficient cooling or incorrect ignition timing, normally are the cause. Normal conditions are usually identified by white, powdery deposits, or rusty-brown to greyish-tan powdery deposits.

(2) Clean the spark plugs with a suitable sand blast cleaner following the manufacturers instructions.

(3) Remove carbon and other deposits from the threads with a stiff wire brush.

(4) Dress the electrodes with a small file to secure flat, parallel surfaces on both the centre and the side electrode.

(5) Adjust the spark plug gap by bending the ground electrode, use a wire gauge, and adjust the gap to .035".

(6) Install and tighten to 30 lbs./ft. torque. Do not use gaskets.

Distributor Cap, Rotor and Wires

(1)Remove wires from distributor cap and examine cap and rotor for cracks, carbon tracks, electrode wear or other damage. Use a small round stiff bristle brush if necessary, to clean corrosion from the wire terminal towers.

(2) Using a weak solution of liquid soap or detergent diluted with warm water, thoroughly scrub the inner and outer surfaces of the distributor cap. Flush with hot water, shake out excess water and dry thoroughly. Do not use compressed air to dry or blow out the water.

(3) Inspect the spark plug cables and coil high tension cable for worn, cracked or damaged insulation, or any condition that may cause current leakage. Check cables for open circuit, loose terminals and high resistance. Replace cable if the resistance is more than 30,000 ohms or if a terminal has pulled off. Check for hardened or split cable nipples, replace as required.

Distributor Resistance

Excessive resistance of the ignition primary circuit from the distributor side of the coil, through the points and the distributor ground will prevent the coil from producing sufficient output for good over-all ignition.

NOTE: The following service operations can best be performed with the distributor mounted in a reliable distributor tester.

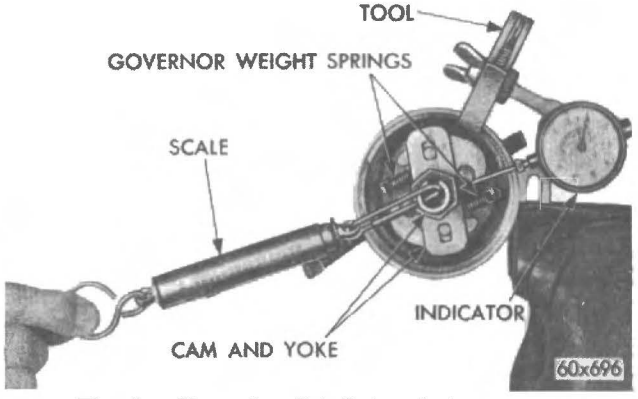


Fig. 1 - Measuring distributor shaft side play (typical).

Distributor Point Replacement

If the distributor shaft appears to have excessive side play, measure and replace parts as necessary (Fig. 1). (See Group 8 - Electrical).

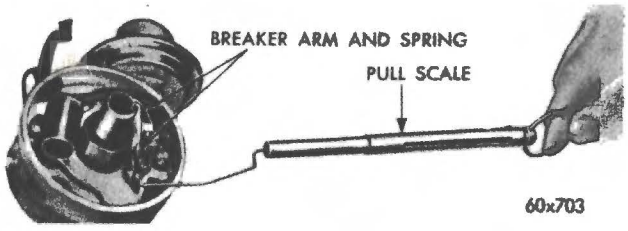


Fig. 2 - Testing breaker arm spring tension.

Excessive wear changes the point gap, causing dwell variations which will effect ignition timing and engine performance.

(1) Remove the old contact points and install a new set.

(2) Align the contacts to provide centre contact by bending the stationary contact bracket only. NEVER BEND MOVABLE ARM TO OBTAIN ALIGNMENT.

(3) After aligning the points, adjust the point gaps to specifications using a dial indicator.

(4) Test and adjust the breaker arm spring tension, by hooking a spring scale on the breaker arm. Pull the scale in a straight line at right angles to the point surfaces (Fig. 2) and read the scale as the points start to separate.

(5) If spring tension is not within specifications (14 - 17½ oz.), another breaker lever must be installed.

(6) Lubricate the breaker lever pivot with one drop of light engine oil. Apply a small amount of heat resisting grease to a clean cloth and very lightly wipe over the distributor cam.

CAUTION: Excessive lubricant on the cam may be thrown off when hot and find its way between the contact points, causing ignition failure.

Point Dwell Test

The degrees of dwell of the distributor breaker points, are the degrees of rotation through which the breaker points remain closed. This is also commonly referred to as "cam angle" or "dwell angle".

Correct distributor point dwell is essential for good ignition performance and point life. Test procedures are as follows:

(1) Connect the tach-dwell red lead to the distributor terminal of the coil, and black lead to a good ground.

(2) Turn the selector to the 6 lobe position.

(3) Turn motor switch to correct rotation position. Adjust speed control until tachometer reads 200 r.p.m. and observe meter reading. This should be within specifications if contact opening is correct and cam and rubbing block, and breaker arm are in satisfactory condition. If the reading is not within specifications, incorrect point gap, defective cam, worn rubbing block or distorted breaker cam are indicated.

Distributor Advance (Test and Adjustments)

Mount the distributor assembly (less cap and rotor) in a reliable stroboscope - type distributor tester and proceed with test.

For centrifugal advance, connect the tach-dwell lead to the distributor primary lead or terminal and proceed as follows:

(1) Turn the selector switch to the 6 Lobe position.

(2) Turn the motor switch to correct rotation position. Adjust the speed control until the tachometer reads 100 r.p.m.

(3) Align the "O" of the distributor tester degree ring with any one of the arrow flashes.

(4) Adjust the tester speed control to operate the distributor at speeds called for in specifications and observe arrow flashes opposite tester degree ring to determine degrees of advance.

(5) If the advance is not according to specifications new springs should be fitted. Adjustment to spring tensions can also be made by bending the spring tabs to increase or decrease the spring tension. Bending the spring tabs toward the distributor cam decreases the spring tension and advances the spark, whilst bending tabs away from distributor cam increases spring tension and retards the spark.

Vacuum Diaphragm Leak Test

For vacuum diaphragm leak test, mount the distributor in distributor tester and with vacuum unit attached to the distributor, proceed as follows:

(1) Place thumb over end of vacuum pump hose and adjust the regulator control knob to give a reading of 20" with hose closed off to ensure tester hose does not leak.

(2) Attach the vacuum pump hose to the tube on the vacuum unit. The vacuum gauge should hold on maximum vacuum obtainable if no leak exists.

(3) Observe breaker plate whilst performing the leak test, to check response of breaker plate to vacuum advance. There should be instant response to the pull of the diaphragm, moving the plate without drag or bind.

(4) If leakage is indicated, replace the vacuum unit. (Refer "Distributor Overhaul" in Group 8).

Vacuum Advance

For vacuum advance connect tester vacuum pump hose to distributor vacuum advance unit and perform steps 1 to 5 of Centrifugal Advance. Then proceed as follows:

(1) Turn the tester vacuum pump ON. Adjust the vacuum pump regulator to vacuum test specifications. See Specifications and observe the arrow flashes on the tester degree ring to determine the degrees of advance.

(2) If the vacuum advance is above or below specifications, some correction can be made by shim adjustment of the diaphragm spring.

When carrying out this adjustment be careful to use two spanners, one to hold the hexagonal extension of the diaphragm housing, whilst removing the sealing plug with the other. If this precaution is not observed, undue strain will be imposed on the diaphragm housing and leakage could be caused.

The link which joins the diaphragm to the distributor plate is pre-set at manufacture and should not be altered.

If the shim adjustment set out above is insufficient, replace the vacuum advance unit.

Replace distributor on engine. (See Group 8 - Ignition System).

Coil and Condenser

The ignition coil is designed to operate with an external ballast resistor. When testing the coil for output, include the resistor in tests. Check the coil for external leaks and arcing. Always make two tests when checking the coil, one when coil is cold, and again with coil warm.

To check the high tension circuit, pull the high tension cable from the distributor centre tower. Hold the end of the cable about $\frac{1}{4}$" away from the cylinder head and crank engine with the ignition switch turned on. If spark jumps the $\frac{1}{4}$" gap, the coil can be considered satisfactory.

Test the capacity of the condenser with a reliable condenser tester. Refer to specifications for condenser capacity in microfarads.

Ignition Timing

To obtain maximum engine performance, the distributor must be correctly positioned on the engine to give correct ignition timing.

The ignition timing test will indicate the timing of the spark at No. 1 cylinder at idle (only). Test procedures are as follows:

(1) Disconnect the vacuum hose at distributor.

(2) Connect the secondary lead of Power Timing Light to No. 1 spark plug, red primary lead to positive terminal of battery and black primary lead to the negative battery terminal.

NOTE: Do not puncture the wires, boots or nipples with test probe - always use adapters. Breaking of the rubber insulation may permit secondary voltage to arc to ground.

(3) Start the engine and set the idle to 500 r.p.m., engine at normal operating temperature (transmission in neutral).

(4) Using a timing light, observe the position of timing mark on the crankshaft damper, and check against specifications.

(5) Loosen the distributor hold down lock plate screw and rotate the distributor housing so that the specified timing mark on damper aligns with the specified "BTC" mark on timing plate. (Moving distributor housing anti-clockwise advances timing, clockwise retards timing.)

(6) Tighten the distributor hold down lock plate screw after the timing has been set and re-check timing adjustment with the timing light.

(7) When the spark timing is correct reconnect the vacuum hose to the distributor.

NOTE: As the engine speed is increased, the timing mark should move down on vibration damper below the pointer if advance units are functioning.

(8) At low altitudes the engine will give its best performance if timed according to specifications. When using lower grade fuels or after carbon has accumulated, objectionable pinging may occur with the specified timing. In cases of this nature, ignition timing should be retarded but not to exceed 5^{o} of crankshaft rotation later than specified. At high altitudes using premium fuel, there is less tendency for the engine to ping. In such cases, improved performance may be obtained by advancing the spark not to exceed 5^{o} of crankshaft rotation ahead of specified timing. Within the foregoing limits of 5^{o} ahead to 5^{o} later than specified timing, a good rule to follow is to advance the spark until a slight ping is heard when accellerating from 15 m.p.h. in direct drive at wide open throttle.

Ignition System Specifications

Spark Plug type	N 14Y
Gap	.035"
Breaker Point Gap	.012"-.016"
Dwell Angle	36^{o} - 40^{o}
Breaker Arm Spring Tension	14 - $17\frac{1}{2}$ oz.
Distributor rotation ..	Clockwise
Timing (Manual Trans.) ..	$2\frac{1}{2}^{o}$ B.T.C.
Timing (Auto. Trans.) ..	5^{o} B.T.C.
Condenser Capacity ..	.275 mfd. $\pm$ 15%

Distributor Advance Specifications

(Distributor Degrees at Distributor r.p.m.)

Centrifugal Advance

Deg. Adv. (Total)	Begin rpm	5^{o} rpm	10^{o} rpm	End rpm
10.50 - 12.50	330-480	700-850	1400-2100	2000-2300

Vacuum Advance

(Distributor Degrees at In. of Mercury)

Deg. Adv. (Total)	Begin Ins.	End Ins.
5.50 - 7.50	5 - $7\frac{1}{8}$ In.	13 In.

A decrease in the rate of advance (kink in the advance curve) takes place at 8^{o} of advance.

5. BATTERY

Electrolyte Test:

The specific gravity of the battery electrolyte indicates the state of charge of the battery. Do not take hydrometer readings immediately after refilling the battery with distilled water. Always use the temperature correction as indicated on the

thermometer scale. Draw electrolyte into the hydrometer several times to obtain accurate readings. A fully charged battery has a temperature corrected gravity reading of 1.255 to 1.275. A reading of 1.220 or lower indicates that the battery should be recharged. A difference of .015 between any two cells in a battery needing a recharge, indicates that the battery should be cycled at least once in order to decrease this difference.

Voltage Test:

Freshly charged batteries have a "surface charge" which causes high and inaccurate readings unless properly dissipated.

If battery is in vehicle, turn headlights on for one to three minutes to remove surface charge. Then turn lights off and wait several minutes before taking another reading.

To make battery test, contact the prods of a test voltmeter to the correct cell terminals (red to positive, black to negative) using caution not to connect across more than one cell. The point of prod will have to be pushed through sealing compound to make contact with buried link for each cell reading.

The individual cell reading should not vary more than 0.15 volt between any two cells. A battery varying more than this should be recharged and a high rate discharge tester used to check battery before discarding battery as unsuitable for further use.

High Rate Discharge Test

Satisfactory capacity tests can be made only when battery equals or exceeds 1.220 specific gravity at 80°F. If reading is below 1.220, the battery should be slow charged in order to secure correct test results.

(1) Turn control knob of battery starter tester to the "Off" position.

(2) Turn voltmeter selector switch to the 16 volt position.

(3) Connect test ammeter and voltmeter positive leads to battery negative terminal and ammeter and voltmeter negative leads to battery positive terminal (Fig. 3).

NOTE: The voltmeter clips must contact the battery posts or cable clamps and not the ammeter clips.

(4) Turn control knob clockwise until ammeter reading is equal to three times the amp-hour rating of the battery.

(5) Maintain load for 15 seconds. Voltmeter should read 9.5 volts or more, which will indicate battery has good output capacity.

(6) Turn control knob to "Off" position.

6. STARTER AND CABLES

Current Resistance and Current Draw Test

Test the battery. If it tests 1.210 specific gravity or less, engine at normal operating temperature, charge the battery. Test the circuit resistance and the starter current draw as follows:

(1) Disconnect the positive battery lead from the battery terminal post.

(2) Connect an 0 to 300 scale ammeter between the disconnected lead and the battery terminal post.

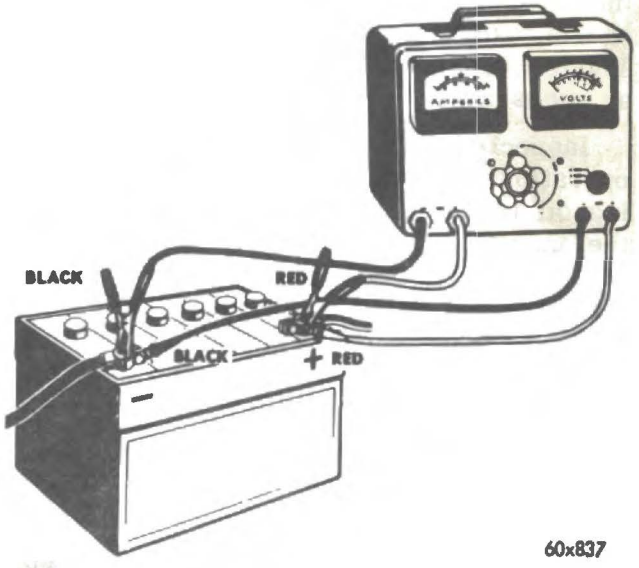


Fig. 3 - High rate discharge test.

(3) Connect a test voltmeter with .10 volt scale divisions between the battery positive post and the starter switch terminal at the starter.

(4) Crank the engine and observe the readings of the voltmeter and the ammeter. The voltage should not exceed .12 volt per 100 amperes of current. The current should not exceed 120 to 225 amperes. A reading of voltage that exceeds .12 volt per 100 amperes, indicates there is a high resistance caused by loose circuit connections, defective cables, burned starter relay or solenoid switch contacts. A current that is high and is combined with slow cranking speed, indicates that the starter should be removed and repaired (Refer Group 8 - "Electrical" for details of starter repair).

7. COOLING SYSTEM AND BELTS

(1) Check level of coolant. Inspect the entire system for leaks. Inspect the condition of the hoses and replace soft or cracked hoses.

(2) Inspect belts and adjust tension if required (Refer Group 7 - Cooling).

8. MANIFOLD AND HEAT CONTROL VALVE

Inspect for evidence of leaking intake manifold gaskets. With the engine idling, squirt kerosene or light engine oil around the gasket areas. A leak will generally be indicated by a change in engine r.p.m. and/or excessive smoke from the exhaust. Tighten manifold bolts or replace gaskets as necessary.

Inspect heat control valve for free operation. Apply suitable graphite penetrating oil to both ends of the valve shaft when the manifold is cool, then work the shaft back and forth until the shaft moves freely. Open control valve by moving the counterweight approximately $\frac{1}{2}$", the counterweight should return freely to its normal position.

9. FUEL SYSTEM

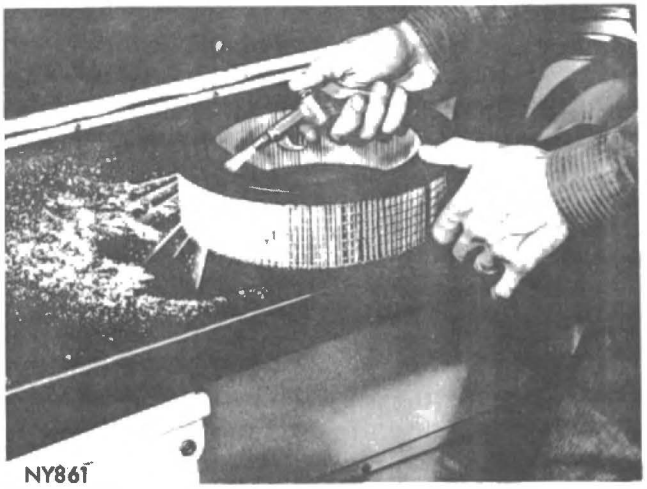
Carburettor Air Cleaner

(1) Remove the air cleaner assembly from the carburettor and remove cover and filter element.

(2) Clean the housing and cover with compressed air.

(3) Using compressed air, gently clean paper element by holding air nozzle at least two inches from the inside screen (Fig. 4).

Examine the paper element for punctures. Discard an element that has even a pin-point puncture. Replace soft plastic sealer if sealing surfaces are not smooth and uniform.



NY861

Fig. 4 - Cleaning air filter.

Oil Filler Pipe Air Cleaner

(1) Clean the air cleaner in kerosene and re-oil with SAE 30 engine oil.

Throttle Linkage

(1) Before setting the throttle linkage, make sure no binding exists in any part of the linkage. Make sure the choke is fully open and the fast idle cam is released.

(2) Adjust the linkage (Refer Group 14 - Fuel System).

Automatic Choke Unit

To function correctly, it is important that all parts be clean and move freely.

(1) Move the choke rod up and down to check for free movement, and possible interference between the choke arm and bottom of air cleaner.

(2) If choke plate is difficult to operate, free-up the choke piston and/or linkage with a suitable solvent.

Apply the solvent through the piston link opening in the carburettor air horn. Operate the choke plate back and forth until gum formation is flushed out and the choke plate moves freely.

Fuel Pump

If the fuel pump fails to supply fuel properly to the carburettor, the following

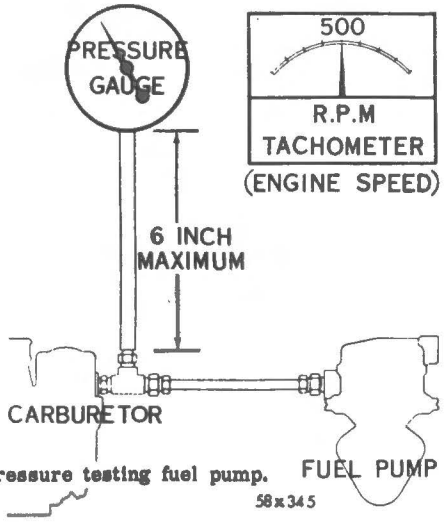


Fig. 5 - Pressure testing fuel pump.

test should be made before removing it from the vehicle.

If leakage is not apparent, test pump pressure as follows:

(1) Insert a "T" fitting in the fuel line at the carburettor, as shown in Fig. 5.

(2) Connect a 6" piece of hose between the "T" fitting and gauge C-3411. (The hose should not exceed 6 inches. A longer hose may collect fuel and the additional weight of the fuel would be added to the pressure of the pump and result in an inaccurate reading).

(3) Connect a tachometer, then start the engine and run at 500 r.p.m. The reading should be from $3\frac{1}{2}$ to 5 p.s.i. and remain constant or return to Zero very, very slowly when the engine is stopped. An instant drop to Zero indicates a leaky outlet valve.

If the pressure is too low a weak diaphragm main spring or incorrect assembly of the diaphragm may be the cause. If the pressure is too high, the main spring is too strong.

Carburettor

(1) Warm up engine to normal operating temperature, then using a tachometer, set the engine idle speed at 550 r.p.m. with idle speed adjusting screw.

(2) Adjust the idle mixture screw until the engine operates smoothly, then re-set idle speed if necessary.

(3) Adjust the fast idle speed to specifications. Refer to procedure set out in "Fuel System" Group 14.

It is important that the fast idle speed is correctly adjusted for cold weather operation.

(4) Check wet fuel level and bowl vent adjustment as set out in Group 14 -'"Fuel System".

PART 2 CLOSED CRANKCASE VENTILATION SYSTEM

SERVICE INFORMATION—PROCEDURES

1. GENERAL INFORMATION

Closed crankcase ventilation is effected by means of air drawn into the crankcase through the oil filler cap, circulated through the engine, and drawn out of the cylinder head cover by manifold vacuum into the combustion chambers and dispelled with the exhaust gases (Fig. 1).

The system consists of a ventilation valve installed in the outlet vent cap on the cylinder head cover, and a tube (capable of withstanding 20 inches of vacuum).

The tube is connected between the outlet vent cap and the lower part of the carburettor throttle body. The function of the valve is to regulate the flow of crankcase ventilation at various throttle positions.

The system will operate effectively as long as normal maintenance is applied. The valve and tube are subject to fouling with sludge and carbon formation due to the nature of the material carried by the ventilating system.

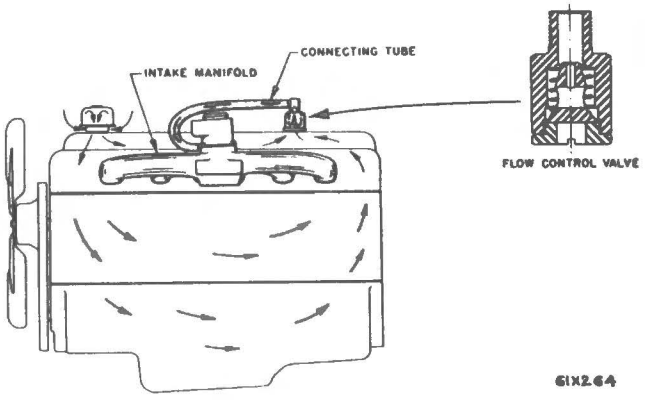


Fig. 1 - Closed crankcase ventilating system.

2. SERVICING

Early AP5 Models 1s

Crankcase ventilator valves fitted to engines with engine serial numbers prefixed "T" should be serviced in the following manner.

Every 8,000 miles remove valve and cap assembly from rocker cover and detach from hose. Remove valve from cap. Soak valve in suitable carburettor cleaner and blow out with compressed air. If valve has been correctly cleaned, shuttle valve will click when unit is shaken and outlet passage should be clean. If valve is badly plugged and cannot be cleaned by this procedure, it will be necessary to disassemble valve and thoroughly clean all elements (see Fig. 2). If valve is disassembled, great care should be taken not to stretch spring, and to reassemble pieces in correct order.

NOTE: The free height of spring is 9/16".

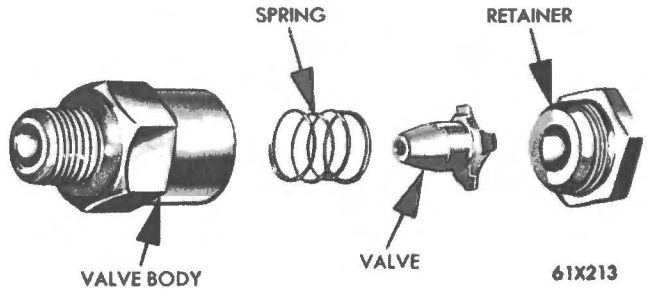


Fig. 2 - Crankcase ventilation valve.

When re-assembling valve parts, make sure the spring is attached to the valve by pushing the end coil over tapered end of valve over ridge and into groove machined just under head of valve. This is very important. Unless spring is correctly assembled, valve will not contact valve seat squarely and will not close correctly. Consequently, engine will not idle correctly, due to entrance of too much air into intake manifold. If spring has been stretched, the same trouble may occur.

If incorrect action of spring is suspected due to spring being distorted, bent, or etched from corrosive action, valve assembly should be replaced. Whilst ventilation valve and cap assembly are removed for cleaning, put a finger over open end of ventilator hose and have engine started. If ventilator hose and carburettor passages are open and operating normally, a strong suction will be felt and there will be a large change in engine idle quality with end of hose uncovered. If these conditions are not observed, carburettor passages and/or ventilator hose are plugged and must be cleaned. Carburettor should be removed from engine and ventilation passages cleaned by dipping lower part of carburettor in cleaner. A pipe cleaner or wire can be used to aid cleaning passages.

It is not necessary to disassemble the carburettor for this cleaning operation.

NOTE: In cold weather when vehicles are operated at slow speeds with low engine temperatures, there may be more rapid accumulations of harmful fumes in the engine. In these conditions, valve and tube must be cleaned more frequently than specified above.

No specific mileage recommendations can be made for these conditions. Frequency of cleaning must be dictated by experience.

Late AP5 and AP6 Models

Crankcase ventilator valves fitted to AP5 engines with engine serial number prefixed "V" and AP6 engines should be serviced in the following manner.

Every 4,000 miles

With the engine running at idle, remove the ventilator valve and cap assembly from the rocker cover. If the valve is not plugged a hissing noise will be heard as air passes through the valve and a strong vacuum should be felt when a finger is placed over the valve inlet. Replace the ventilator valve and cap assembly and remove the oil filler breather cap. With the engine still running at idle, loosely hold a piece of stiff paper or cardboard over the oil filler pipe. It should be sucked against the oil filler pipe with a noticeable force after approximately one minute when crankcase pressure has been reduced. If this occurs, a final test should be made to be certain the valve shuttle is free. A clicking noise should be heard when the valve is shaken (engine not running). If the noise is heard, the unit is satisfactory and no further service is necessary.

However, if valve is plugged with sludge, detach valve and cap assembly from the ventilator hose and soak valve assembly in lacquer thinners then blow out with compressed air.

NOTE: The only solvent recommended for this cleaning operation is lacquer thinners.

Every 8,000 miles

Remove the valve and cap assembly from the rocker cover and detach from hose. Remove valve from cap. Soak the valve in lacquer thinners then blow out with compressed air. If the valve has been correctly cleaned, the shuttle valve will click when the unit is shaken, and the outlet passage should be clean. If the valve is badly plugged and cannot be cleaned by this procedure, it will be necessary to replace the valve assembly.

Whilst the ventilator valve and cap assembly is removed for cleaning, place a finger over the open end of the ventilator hose and have the engine started. If the ventilator hose and carburettor passages are open and operating normally, a strong suction will be felt and there will be a large change in engine idle quality when the end of the hose is uncovered. If these conditions are not observed, the carburettor passages and/or ventilator hose are plugged and must be cleaned by dipping the lower part of the carburettor in solvent. A pipe cleaner or wire can be used to aid in cleaning the passages. It is not necessary to disassemble carburettor for this cleaning operation.

Every 12,000 miles

Check the operation of the valve as outlined in the 4, 000 mile service.

Every 16,000 miles

Remove the valve and cap assembly from the rocker cover and install a new ventilator valve. Check the operation of the system as outlined in the 4, 000 mile service.

Clean ventilator hose if necessary.

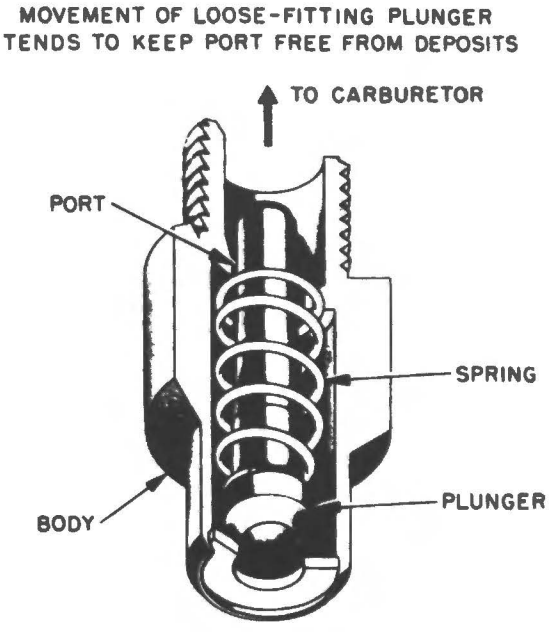


Fig. 3 - Crankcase Ventilator Valve. (Cut-away View).

PART 3

THE ENGINE ASSEMBLY
6 CYLINDER

SPECIFICATIONS

ENGINE

Type	In-line OHV
Number of cylinders	6
Bore	3.401"
Stroke	4.125"
Piston displacement	225 cu. ins.
Compression ratio	
Engines with Engine Serial Numbers prefixed "T"	8.2 : 1
Engines with Engine Serial Numbers prefixed "V" or "A"	8.4 : 1
Compression pressure with engine warm, spark plugs removed, wide open throttle at minimum cranking speed of 130 RPM	110 - 140 p.s.i.
Maximum variation between cylinders	20 p.s.i.
Firing order	1-5-3-6-2-4

CRANKSHAFT

Type	Fully counterbalanced
Bearings	Steel-backed babbit
Main bearing journal diameter	2.7495" - 2.7505"
Connecting rod journal diameter	2.1865" - 2.1875"
Maximum out-of-round permissible	.001"
Number main bearings	4
Clearance desired	.0005" to .0015"
Maximum clearance allowable before reconditioning	.0025"
End play	.002" to .007"
Thrust taken by	No. 3 main bearing
Finish at rear seal surface	Diagonal knurling
Interchangeability of bearings	Upper Nos. 2, 4 Lower Nos. 1, 2, 4

MAIN BEARING (SERVICE)

All available in standard and the following undersizes	.001", .002", .003", .010", .012".

CONNECTING RODS AND BEARINGS

Type	Drop forged "I" beam
Length (Centre to centre)	6.697" - 6.701"
Weight (Less bearing shells)	26.8 oz.
Bearings	Steel-backed babbit
Diameter and length	2.1870" x 1.015"
Clearance desired	.0005" to .0015"
Maximum allowable before reconditioning	.0025"
Side clearance	.006" to .012"
Bearing for service	Standard .001", .002", .003", .010", .012" U.S.
Piston pin bore diameter	.8995 to .9000"

CAMSHAFT

Drive	Chain
Bearings	Steel-backed babbit
Number	4
Thrust taken by	Cylinder block
Clearance	.001" to .003"
Maximum allowable before reconditioning	.005"

CAMSHAFT BEARING JOURNALS

Diameter:	
No. 1	1.998" - 1.999"
No. 2	1.982" - 1.983"
No. 3	1.967" - 1.968"
No. 4	1.951" - 1.952"

CAMSHAFT BEARINGS

Diameter (after reaming):	
No. 1	2.000" - 2.001"
No. 2	1.984" - 1.985"
No. 3	1.969" - 1.970"
No. 4	1.953" - 1.954"

TIMING CHAIN

Number of links	50
Pitch	.50"
Width	.88"

TAPPETS

Type	Mechanical
Clearance in block	.0012" - .0025"
Body diameter	.9040" - .9045"
Clearance between valve stem and rocker arm pad (engine hot)	.010" - Intake .020" - Exhaust

PISTONS

Type	Horizontal slot W/Steel struts
Material	Aluminium alloy tin coated
Land clearance (diametral)	.025" to .030"
Clearance at top of skirt	.0005" to .0015"
Weight (Std. to .040" oversize)	16 oz.
Piston length (over all)	3.51"
Ring Groove Depth:	
No. 1	.179"
No. 2	.179"
No. 3	.181"
Pistons for service	Standard .005", .020", .040" O/S

PISTON PINS

Type	Press fit in rod
Diameter	.9007" - .9009"
Length	2.955" - 2.976"
Clearance in piston	.00045" - .00075"

Interference in rod	.0007" - .0014"
Piston pins for service	Standard only
Direction offset in piston	Toward right side of engine

PISTON RINGS

Number of rings per piston	3
Compression	2
Oil	1
Width of rings:	
Compression	.0775" - .0780"
Oil	.1860" - .1865"
Piston ring gaps (Compression)	.010" - .020"
Service rings (Oil control)	.015" - .062"

RING SIDE CLEARANCE (SERVICE RINGS)

Compression:	
Upper	.0015" to .0040"
Intermediate	.0015" to .0040"
Oil	.009" Max.

VALVES — INTAKE

Material	Aluminium coated carbon manganese steel
Head diameter	1.615" - 1.625"
Length (to gauge dimension line)	4.6878" - 4.7028"
Stem diameter	.372" - .373"
Stem to guide clearance	.001" - .003"
Maximum allowable before reconditioning	.004"
Valve face angle	45°
Adjustment	Rocker arm screw
Lift	.375"

VALVES — EXHAUST

Material	Nitrogen treated manganese chromium nickel steel
Head diameter	1.355" - 1.365"
Length (to gauge dimension line)	4.6878" - 4.7028"
Stem diameter	.371" - .372"
Stem to guide clearance	.002" - .004"
Maximum allowable before reconditioning	.006"
Valve face angle	47°
Adjustment	Rocker Arm Screw
Lift	.360"

VALVE SPRINGS

Number	12
Free length	2"
Load when compressed to (valve closed)	49 - 57 lb. @ 1 11/16".
Load when compressed to (valve open)	137 - 150 lb. @ 1 3/16"
Valve springs I. D.	1.02"

VALVE TIMING

	AP5 Models	AP6 Models
Intake:		
Open	8° BTC	10° BTC
Closed	44° ABC	50° ABC
Duration	232°	240°
Exhaust:		
Open	48° BBC	50° BBC
Closed	TDC	6° ATC
Duration	228°	236°
Valve opening overlap	8°	16°

CYLINDER HEAD

Combustion chamber	Wedge type
Valve Seat run-out (maximum)	.002"
Intake valve seat angle	45°
Seat width (finished)	.070" - .090"
Exhaust valve seat angle	45°
Seat width (finished)	.040" - .060"
Cylinder head gasket (compressed thickness)	.022"

CYLINDER BLOCK

Cylinder bore (standard)	.340"
Cylinder bore out-of-round (max. allowable before reconditioning)	.005"
Cylinder bore taper (max. allowable before reconditioning)	.010"
Reconditioning working limits (for taper and out-of-round)	.001"
Maximum allowable oversize cylinder bore	.040"
Tappet bore diameter	.9050" - .9058"

ENGINE LUBRICATION

Pump type	Rotary - full pressure
Pump drive	Camshaft
Operating pressure at 40 to 50 m.p.h.	45 - 65 lb./sq. ins.
Pressure drop resulting from clogged filter	7 - 9 lb./sq. ins.

TORQUE SPECIFICATIONS

	TORQUE	THREAD SIZE
Connecting rod nut	45 lb./ft.	3/8" - 24 T. P. I.
Cylinder head bolt	65 lb./ft.	7/16" - 14 T. P. I.
Main bearing cap bolt	85 " "	1/2" - 13 "
Spark plug	30 " "	14 m. m.
Camshaft lock bolt	35 " "	7/16" - 14 T. P. I.
Carburettor to manifold bolt	200 lb./in.	3/8" - 16 "
Chain case bolt	15 lb./ft.	5/16" - 18 "
Torque converter housing bolt	30 lb./ft.	3/8" - 16 "
Converter brace to aluminium housing	40 " "	7/16" - 14 "
Converter brace to engine block	30 " "	3/8" - 16 "
Clutch housing bolt	30 " "	3/8" - 16 "
Crankshaft rear bearing seal retainer	30 " "	3/8" - 16 "
Cylinder head cover bolt	40 lb./in.	1/4" - 20 "
Distributor clamp bolt	200 " "	5/16" - 18 "
Engine front mounting to frame nut	85 lb./ft.	1/2" - 20 "
Engine front mounting to block nut	45 " "	7/16" - 20 "
Engine rear mount bolts	35 " "	7/16" - 14 "
		3/8" - 24 "
Exhaust manifold nut	10 " "	5/16" - 24 "
Exhaust pipe flange nut	30 " "	7/16" - 20 "
Exhaust pipe clamp bolt	20 " "	3/8" - 24 "
Exhaust pipe support clamp bolt	20 " "	3/8" - 24 "
Fan attaching bolt	200 lb./in.	5/16" - 18 "
Flywheel housing to cylinder block bolt	50 lb./ft.	7/16" - 14 "
Flywheel housing cover bolt	7 " "	1/4" - 20 "
Fuel pump attaching bolt	30 " "	3/8" - 16 "
Alternator bracket bolt	30 " "	3/8" - 16 "
Alternator mounting nut	200 lb./in.	5/16" - 18 "
Alternator adjusting strap bolt	15 lb./ft.	5/16" - 18 "
Alternator adjusting strap mounting bolt	30 " "	3/8" - 16 "
Intake to exhaust manifold bolt	200 lb./in.	5/16" - 18 "
Manifold heat control counterweight bolt	50 " "	No. 10 - 32 "
Oil pan drain plug	20 lb./ft.	1/2" - 20 "
Oil pan bolt	200 lb./in.	5/16" - 18 "
Oil pump cover bolt	130 " "	1/4" - 20 "
Oil pump attaching bolt	200 " "	5/16" - 18 "
Oil filter attaching stud	30 lb./ft.	3/4" - 16 "
Oil pressure gauge sending unit	60 lb./in.	1/8" N. P. T. F.
Rocker shaft bracket bolt	30 lb./ft.	3/8" - 16 "
Starter mounting bolt	50 " "	7/16" - 14 "
Temperature gauge sending unit	180 lb./in.	1/4 N. P. T. F.
Water pump to housing bolt	30 lb./ft.	3/8" - 16 "

SPECIAL TOOLS

C-119	...	Test Indicator - cylinder bore
C-385	...	Compressor piston ring
C-647	...	Fixture - spring testing
C-756	...	Cleaner - valve guide
C-771	...	Tool - Flywheel turning
C-823 No. 500		Hone - cylinder bore
C-897	...	Driver welch plug
C-3012	...	Reamer - cylinder bore ridge
CA-3026	...	Sleeve - guide wear measuring
CA-3028	...	Reamer set - valve tappet
C-3059	...	Remover and installer - main bearing upper shell
C-3065	...	Gauge - cylinder compression
C-3066	...	Connector - timing light
CA-3068	...	Rack - tappet
C-3092	...	Vice - piston
C-3132A	...	Remover and installer - camshaft bearing
C-3167	...	Stand - engine repair
C-3168	...	Adapter - engine repair stand
CA-3221	...	Remover and installer piston and connecting rod.
C-3339	...	Dial indicator set
C-3422	...	Compressor - valve spring
CA-3427	...	Reamer - valve guide .030" oversize
CA-3430	...	Reamer - valve guide .015" oversize
CA-3433	...	Reamer - valve guide .005" oversize
C-3442	...	Light - ignition timing
C-3501	...	Hone - cylinder bore deglazing
CA-3506	...	Remover and installer - chain cover oil seal.
C-3626	...	Fixture - cylinder head holding
CA-3646	...	Puller - steering arm
C-3661	...	Puller - mechanical tappet
CA-3724	...	Remover and installer - piston pin
CA-3732	...	Puller set - damper pulley
CA-3743	...	Installer - rear main bearing seal
CA-3804	...	Plate - engine lifting
C-3805	...	Installer - piston ring
C-3806	...	Fixture - engine support

SERVICE INFORMATION—PROCEDURES

I. GENERAL INFORMATION

The Valiant engine (see Figs. 1, 1A and 2) is inclined toward the right at an angle of 30^{o} from the vertical in the engine compartment. This design permits a lower hood line and allows space in the engine compartment for the long intake manifold branches. The engine has in-line overhead valves and wedge shaped combustion chambers.

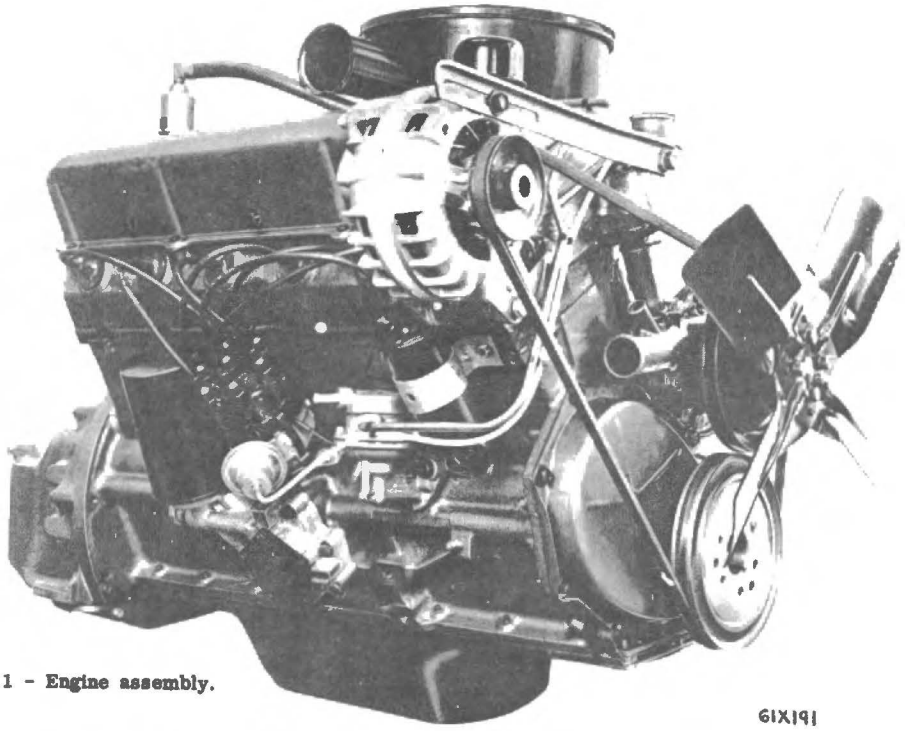


Fig. 1 - Engine assembly.

61X191

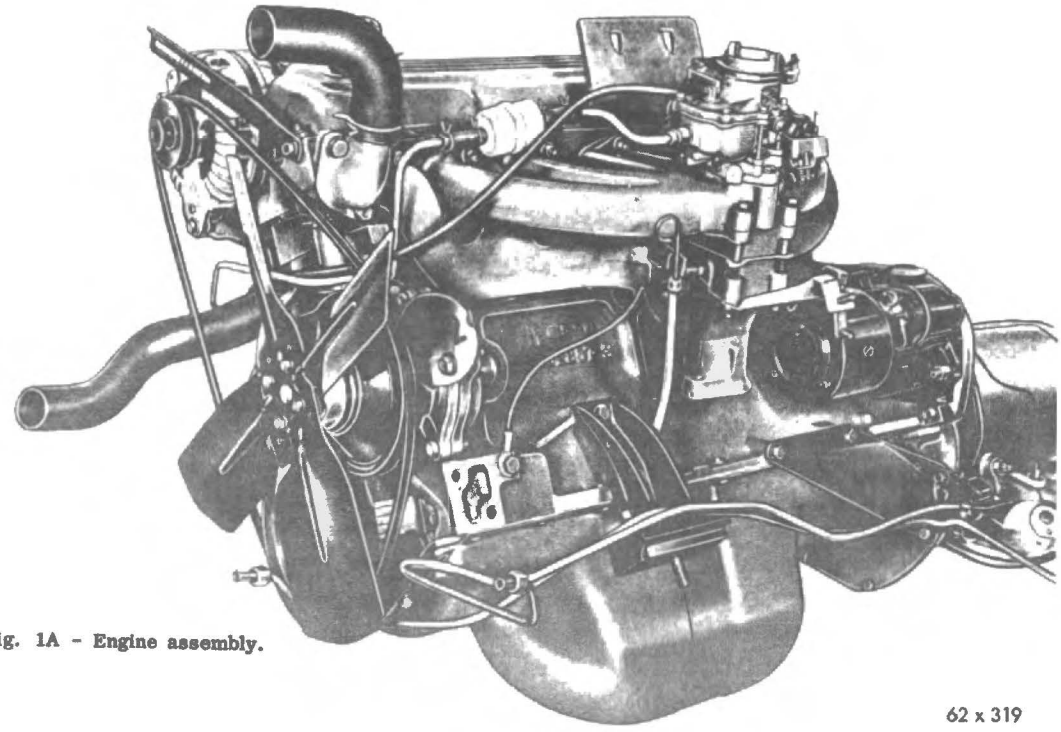


Fig. 1A - Engine assembly.

62 x 319

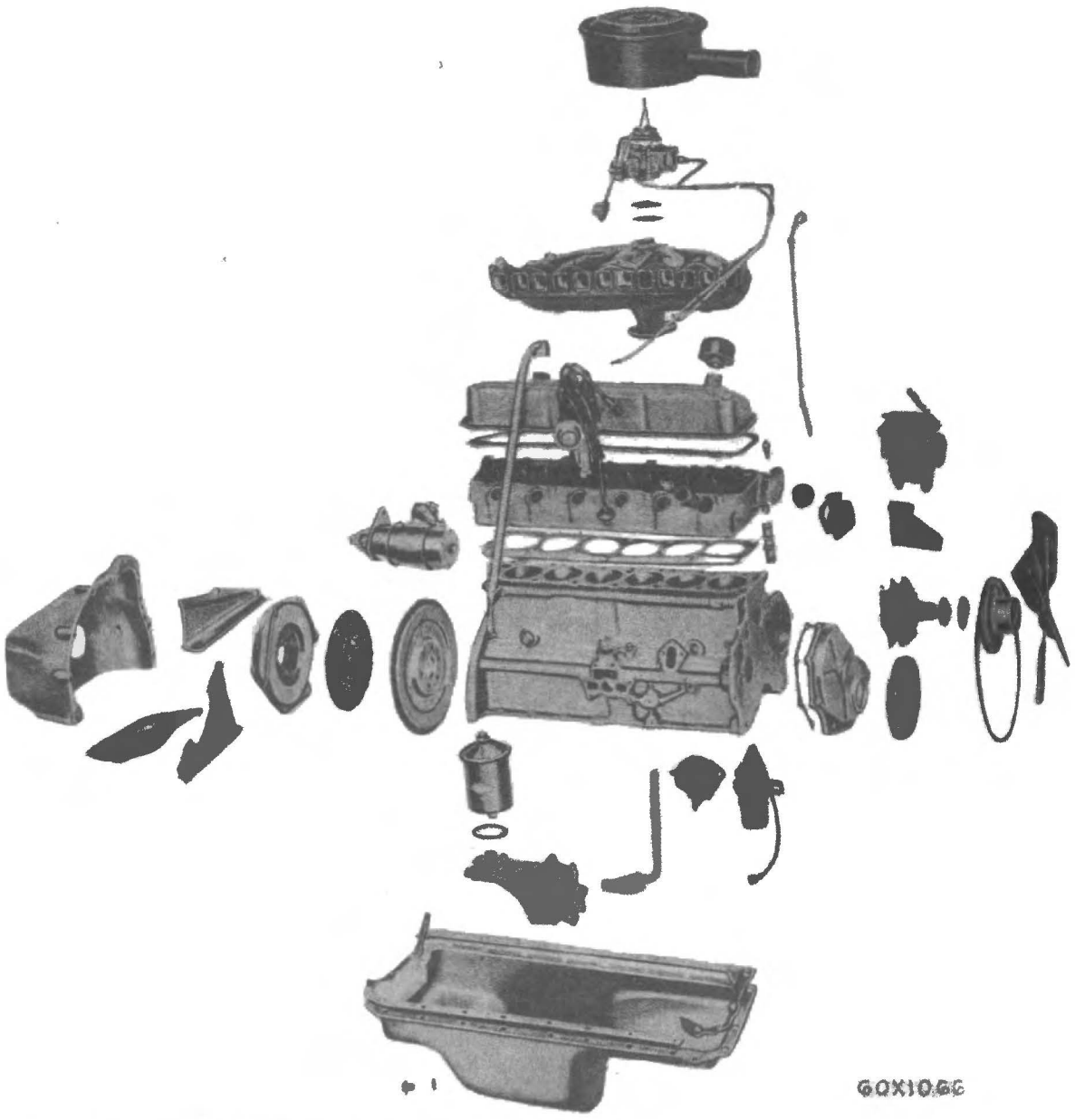


Fig. 1B - Engine assembly (external components).

The lubrication system consists of an externally mounted rotor type pump on the lower right side of the cylinder block. A full-flow replaceable type oil filter is mounted on the engine block on the left side.

Oil is forced by oil pump to a series of oil passages in engine (see Fig. 3). The semi-series flow cooling system contains an aluminium water pump body with a pressed-in ball bearing and seal assembly and plastic impeller. The water pump housing is integral with the cylinder block.

2. ENGINE REPLACEMENT

(1) Mark the hood hinge outlines on hood and remove hood.

(2) Drain the cooling system and remove battery and carburettor air cleaner.

(3) Remove the radiator and heater hoses (if applicable) and remove radiator.

(4) Remove the outlet vent pipe from cylinder head cover.

(5) Disconnect the fuel lines, carburettor linkage and wiring to engine.

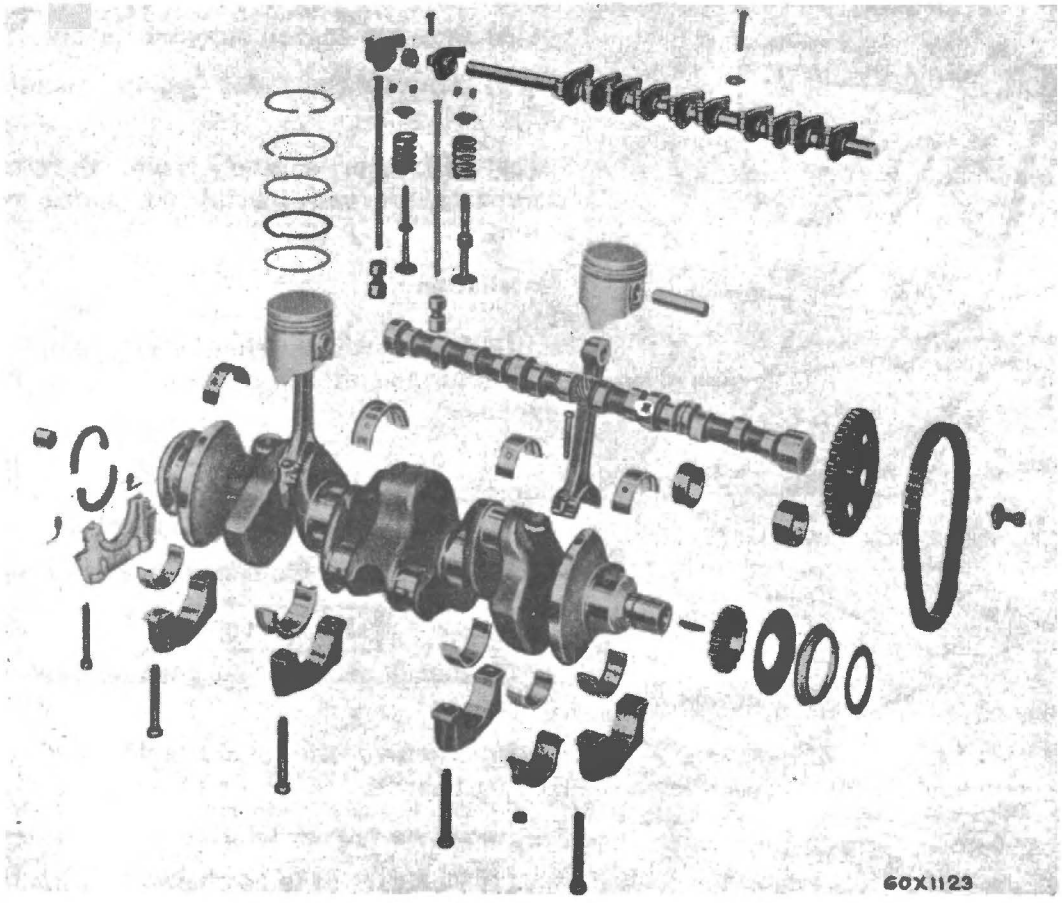


Fig. 1C - Engine assembly (internal components).

(6) Disconnect the exhaust pipe at the manifold, remove exhaust pipe and muffler assembly.

(7) Raise car on hoist.

(8) Drain the converter housing and the transmission. Remove oil cooler lines, filler tube and gear selection cable (Automatic transmission models).

(9) Remove the clutch torque shaft (Manual transmission models) and brake cables.

(10) Remove the speedometer cable and gear shift rods (Manual transmission models).

(11) Disconnect the propeller shaft and tie out of way.

(12) Install the engine support fixture (Tool C-3806) to support rear of engine.

(13) Remove the engine rear support crossmember (see Fig. 4).

(14) Remove the transmission bolts from clutch housing (Manual transmission models) or remove housing bolts (Automatic transmission models).

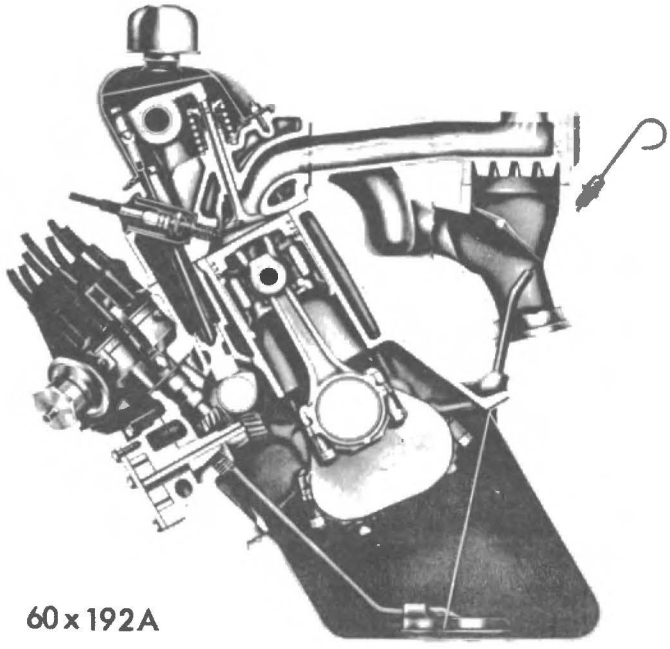


Fig. 2 - Engine - end sectional view.

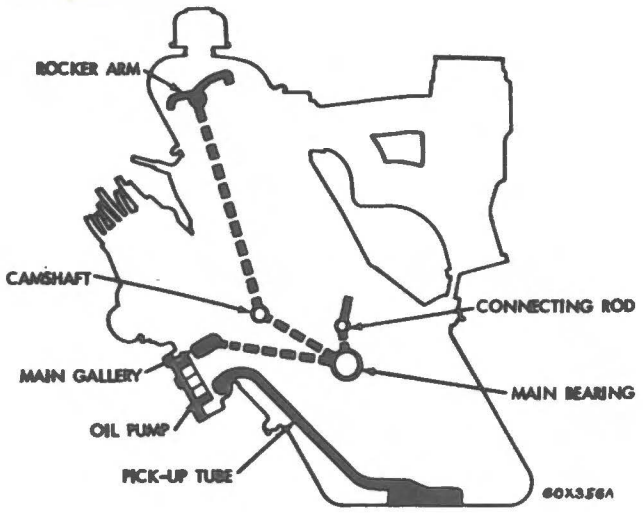


Fig. 3 - Engine oiling system.

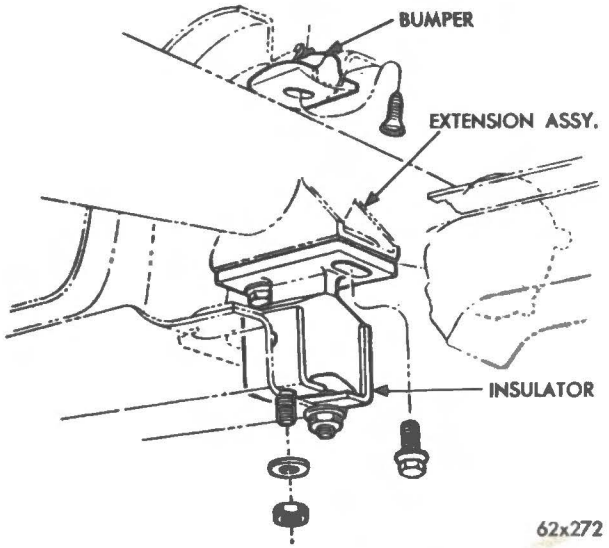


Fig. 4 - Rear engine mount.

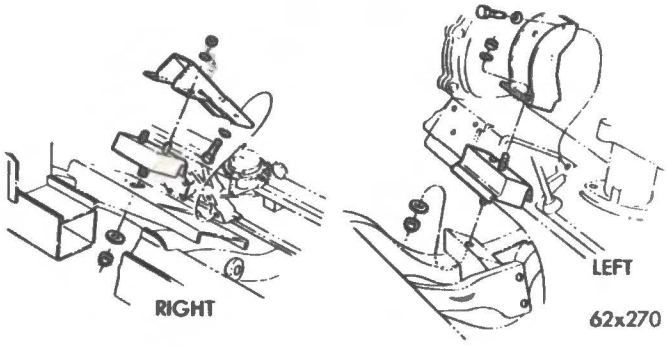


Fig. 5 - Front engine mounts

(15) Remove transmission.

(16) Lower the car.

(17) Install the engine lifting fixture (Tool CA-3804) to the cylinder head and attach a chain hoist to the fixture eye-bolt.

(18) Remove engine support fixture.

(19) Remove the front engine mount bolts (Fig. 5).

(20) Lift the engine from the engine compartment and install on engine repair stand.

Installation

(1) Install the engine lifting fixture Tool CA-3804 and attach a chain hoist to fixture eyebolts.

(2) Lower the engine into the engine compartment until front of engine is positioned on front engine mounts.

(3) Install the front engine mount bolts.

Do not tighten.

(4) Install engine support fixture (Tool C-3806).

(5) Remove the chain hoist and engine lifting fixture.

(6) Raise car on hoist.

(7) Position rear of engine and install the transmission.

(8) Install the engine rear support cross-member.

(9) Connect the propeller shaft at the transmission.

(10) Install the speedometer cable and gear shift rods.

(11) Install clutch torque shaft, (standard transmission) brake cables.

(12) Install oil cooler lines, and transmission filler tube (automatic transmission).

(13) Lower car.

(14) Tighten front engine mount bolts

(15) Connect the exhaust pipe at manifold using a new gasket.

(16) Connect the fuel lines, carburettor linkage and wiring to engine.

(17) Install the outlet vent pipe on cylinder head cover.

(18) Install radiator hoses, battery and

carburettor air cleaner.

(19) Fill the cooling system and transmission.

(20) Install the hood.

3. CYLINDER HEAD

The chrome alloy cast iron cylinder head, as shown in Fig. 6 is mounted on the cylinder block by 14 bolts. The spark plugs are located at the wide edge of the combustion chambers, and aluminium spark plug tubes serve as spark plug gaskets.

Removal

(1) Drain the cooling system.

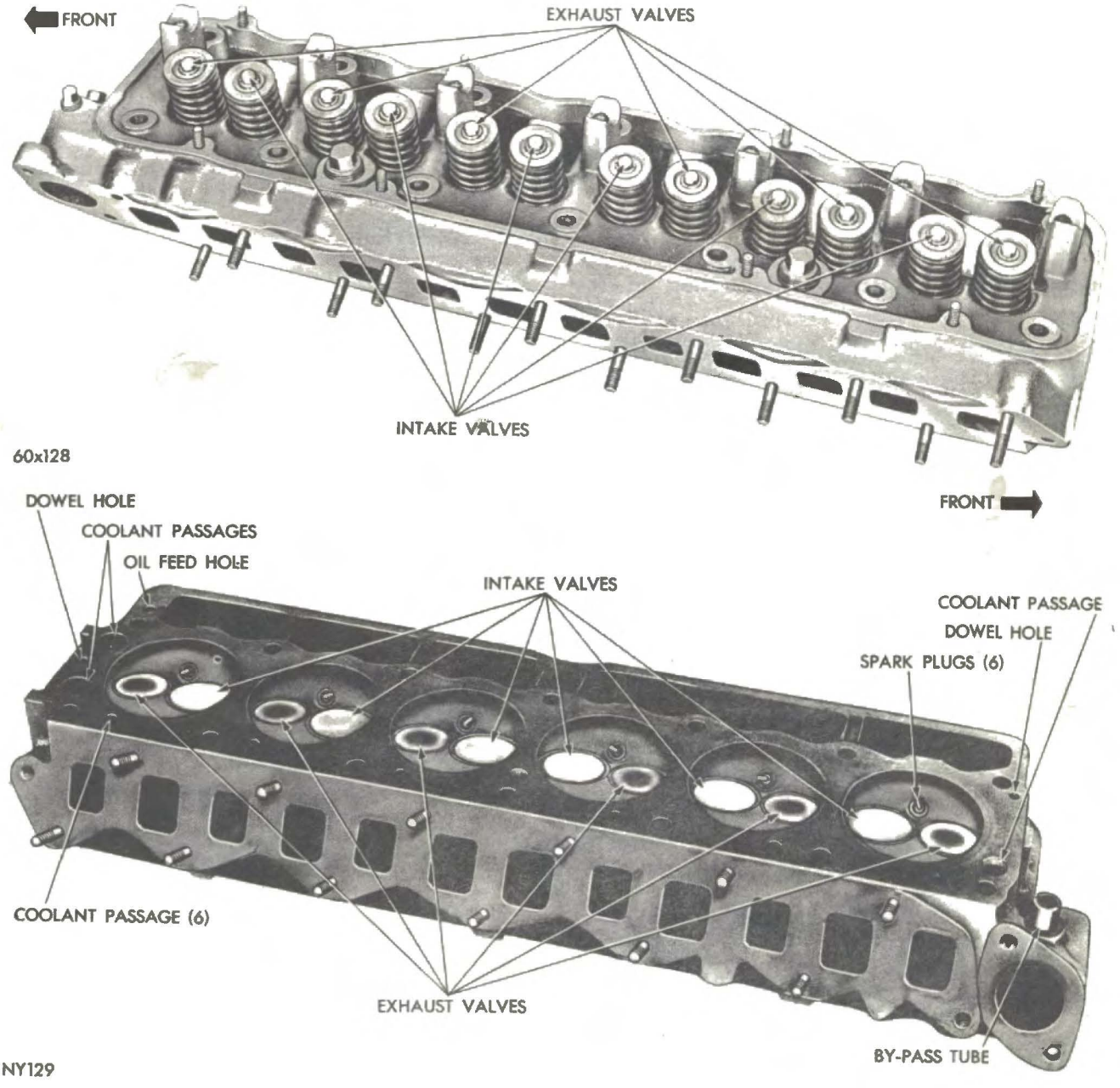


Fig. 6 - Cylinder head.

(2) Remove carburettor air cleaner and fuel line.

(3) Disconnect the accellerator linkage.

(4) Remove the vacuum control tube at carburettor and distributor.

(5) Disconnect the spark plug wires by pulling straight out in line with plug.

(6) Disconnect the heater hose and clamp holding by-pass hose.

(7) Disconnect the heat indicator sending unit wire.

(8) Disconnect exhaust pipe at exhaust manifold flange.

(9) Remove the intake and exhaust manifold and carburettor as an assembly.

(10) Remove the outlet vent tube and cylinder head cover.

(11) Remove the rocker arms and shaft assembly.

(12) Remove the push rods and place them in their respective slots in holder Tool CA-3068.

(13) Remove 14 head bolts and remove cylinder head.

(14) Place cylinder head in holding fixture Tool C-3626 and remove spark plugs.

Installation

(1) Clean all gasket surfaces of cylinder block and cylinder head and install spark plugs.

(2) Check all surfaces with a straight edge if there is any reason to suspect leakage.

(3) Coat the new gasket with a suitable sealer. Install gasket and cylinder head.

(4) Install cylinder head bolts. Starting at top centre, tighten all cylinder head bolts to 65 lbs./ft., in sequence (Fig. 7). Repeat the procedure retightening all head bolts to 65 lbs./ft.

(5) Install rocker arms and shaft assembly with "FLAT" on the end of the rocker shaft ON TOP and pointing toward the front of the engine, (see Fig. 8), to provide proper lubrication to the rocker assemblies.

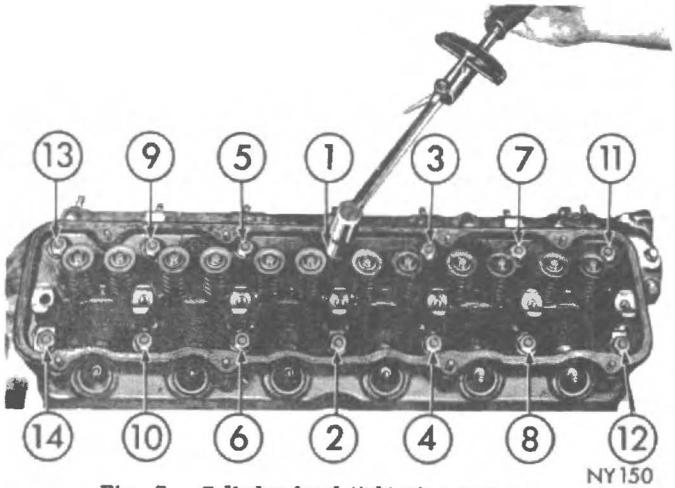


Fig. 7 - Cylinder head tightening sequence.

If shaft does not have a flat.

It is important that care be taken when assembling such shafts to ensure that the oil drain holes are positioned so that they point towards the base or cylinder head end of the valve springs.

Install rocker shaft retainers between rocker arms so that they seat on rocker shaft and not on extended bushing of rocker arm.

Be sure to install long retainer in centre position only. Install rocker shaft bolts (long bolt at rear of engine) and tighten to 30 lbs./ft.

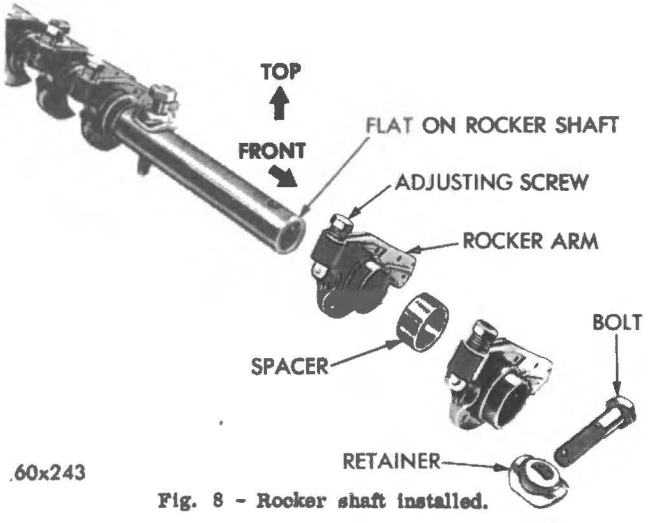


Fig. 8 - Rocker shaft installed.

(6) Loosen the three bolts holding the intake manifold to the exhaust manifold, in order to maintain proper alignment.

(7) Install intake and exhaust manifold and carburettor assembly to cylinder head with the cup side of conical washers against manifolds. Tighten nuts to 10 lbs./ft.

(8) Tighten three bolts holding the intake manifold to the exhaust manifold to 15 lbs./ft.

(9) Connect the heater hose and by-pass hose clamp.

(10) Connect the heat indicator sending unit wire, the accellerator linkage and spark plug wires.

(11) Install the vacuum control tube from carburettor to distributor.

(12) Connect the exhaust pipe to exhaust manifold flange.

(13) Install the fuel line and carburettor air cleaner.

(14) Fill the cooling system.

(15) Operate the engine until normal operating temperature is reached (approximately 180°F water temperature).

(16) Allow the engine to idle at 550 r.p.m. at a temperature of 180°F for 5 minutes.

(17) Adjust intake valve clearance to .010" and exhaust valve clearance to .020" (refer Fig. 9).

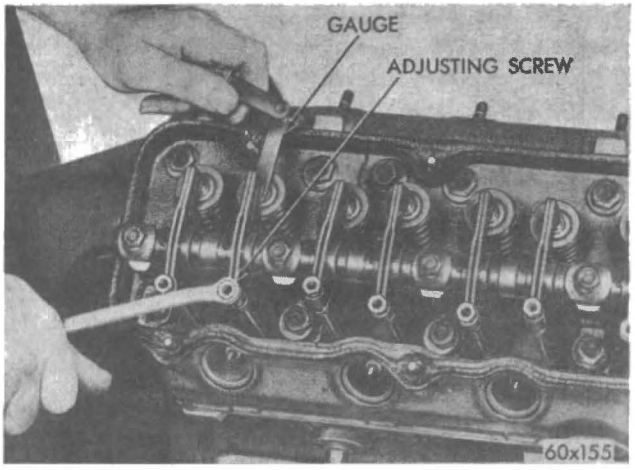


Fig. 9 - Adjusting tappets.

(18) Place the new cylinder head cover gasket in position and install cylinder head cover. Tighten nuts to 40 lbs./ins.

(19) Install closed crankcase ventilation system.

4. ROCKER ARMS AND SHAFT ASSEMBLY

Stamped steel rocker arms are arranged on a single rocker arm shaft. Hardened steel spacers are used between the pairs of rocker arms. The rocker shaft is held in place by bolts and stamped steel retainers attached to the seven brackets on the cylinder head.

Removal

(1) Remove the crankcase ventilator system.

(2) Remove the cylinder head cover and gasket.

(3) Remove rocker shaft bolts and retainers.

(4) Remove rocker arms and shaft assembly.

Installation

(1) Install the rocker arms and shaft assembly (see Fig. 8) with the flat on the end of the rocker shaft on top and pointing towards the front of the engine. This is necessary to provide proper lubrication to the rocker assemblies.

(2) Install the rocker shaft retainers between rocker arms so that they seat on rocker shaft and not on extended bushing of rocker arm.

Be sure to install long retainer in centre position only.

(3) Install the rocker shaft bolts. Install long bolt at rear of engine. Tighten to 30 lbs./ft.

(4) Adjust tappets (hot). Intake .010", exhaust .020".

5. VALVES AND VALVE SPRINGS

Valves are arranged in line in the cylinder head and operate in guides that are integral with the cylinder head.

Removal

(1) With cylinder head removed, compress valve springs using Tool C-3422 (Fig. 10).

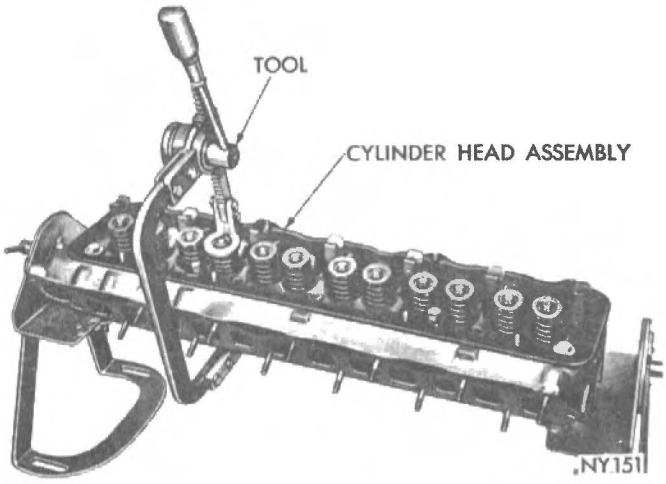


Fig. 10 - Compressing valve springs (Tool C-3422).

(2) Remove the valve retaining locks, valve spring retainers, valve stem cup seals and valve springs.

(3) Remove the burrs from the valve stem lock grooves, to prevent damage to valve guide when valves are removed.

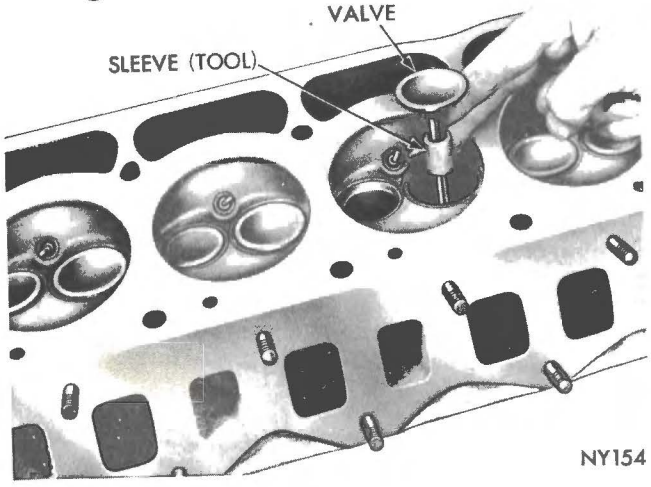


Fig. 11 - Checking wear with sleeves (Tool CA-3026).

Valve Inspection

(1) Clean the valves thoroughly and discard burned, warped and cracked valves.

(2) Measure valve stems for wear. Intake valve stem diameter (new valve) should measure .372" to .373" and exhaust valve stem diameter (new valve) should measure .371" to .372". If the wear exceeds .002" replace the valve.

(3) Remove carbon and varnish deposits from the inside of valve guides with Tool C-756.

(4) Measure the valve stem guide clearance as follows:

Install sleeve Tool CA-3026 over the valve stem and install valve (Fig. 11). The special sleeve places the valve at correct height for checking with dial indicator.

(5) Attach the dial indicator Tool C-3339 to the cylinder head and set it at right angle to the valve stem being measured (Fig. 12).

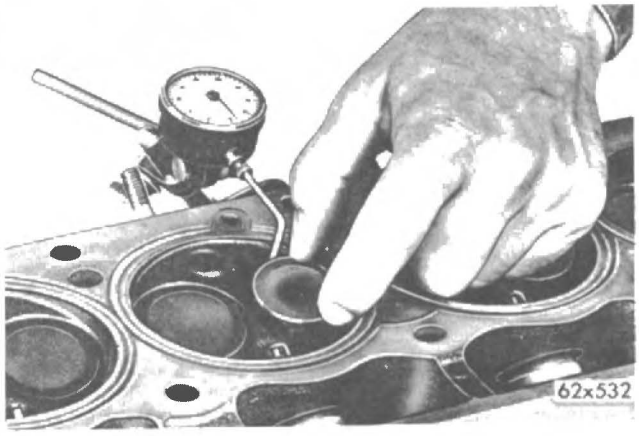


Fig. 12 - Measuring valve guide (Tool C-3339).

(6) Move valve to and from indicator. The total dial indicator reading should not exceed .012" on intake valves, and .017" on exhaust valves. Ream the guides for valves with oversize stems if dial indicator reading is excessive, or if the stems are scuffed or scored. Service valves are available in standard, .005", .015" and .030" oversizes. Reamers to accommodate the oversize valve stems are as follows:

Reamer Tool CA-3433 (.005" oversize).
Reamer Tool CA-3430 (.015" oversize).
Reamer Tool CA-3427 (.030" oversize).

(7) Slowly turn reamer by hand and clean guide thoroughly before installing a new valve.

Do not attempt to ream the valve guides from standard directly to .030" oversize. Use step procedure of .005", .015" and .030" in that order so that the valve guides may be reamed true in relation to the valve seat.

6. REFACING VALVES AND VALVE SEATS

(1) The intake and exhaust valve seats and the intake valve face have a 45 degree angle. The exhaust valve face has a 47 degree angle. The valve face and seat angles are shown in Fig. 13.

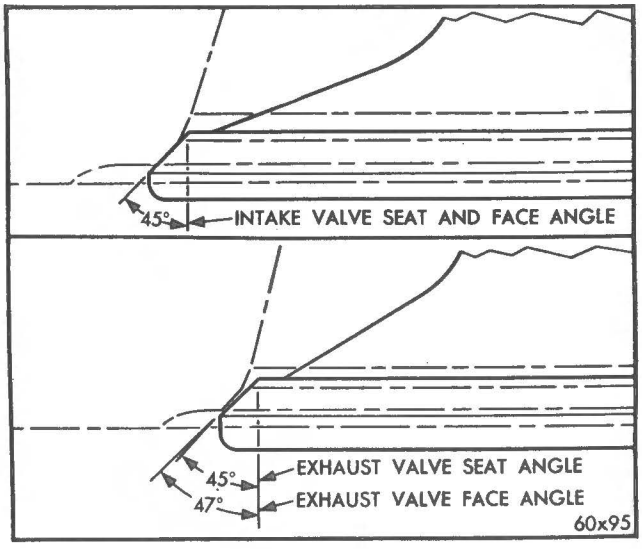


Fig. 13 - Valve face and seat angles.

(2) Inspect the remaining margin after the valves are re-faced (Fig. 14). Valves with less than 3/64" margin should be discarded.

(3) When refacing the valve seats, it is important that the correct size valve guide pilot be used for reseating stones. A true and complete surface must be obtained.

(4) Measure the concentricity of the valve seat using a dial indicator. The total run-out should not exceed .003" (total indicator reading). When the seat is properly positioned, the width of the intake seats should be 5/64" to 3/32". The width of the exhaust seats should be 3/64" to 1/16".

7. TESTING VALVE SPRINGS

(1) Whenever the valves have been removed for inspection, re-conditioning, or replacement, the valve springs should be tested. To test a spring, first determine the length at which the spring is to be tested. As an example, the compressed length of the spring to be tested is 1 5/16". Turn the

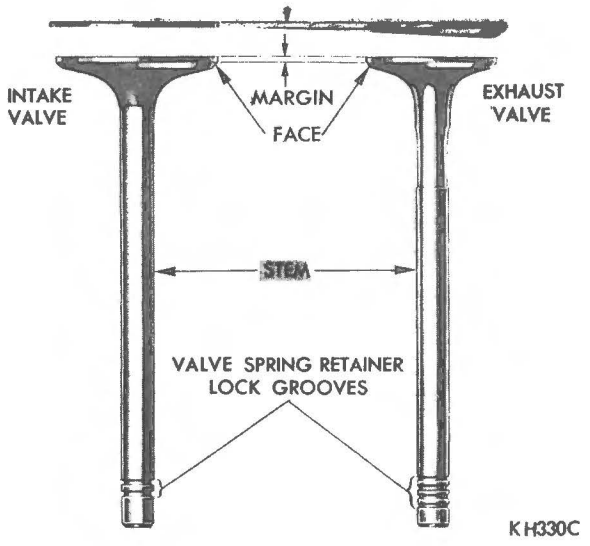


Fig. 14 - Intake and exhaust valve.

table of Tool C-647 until surface is in line with the 1 5/16" mark on the threaded stud and the zero mark to the front. Place spring over stud on table and lift the compression lever to set the tone device. Pull on torque wrench until ping is heard. Take the reading on torque wrench at this instant. Multiply this reading by two. This will give the spring load at the test length. Fractional measurements are indicated on the table of finer adjustments. The valve springs should test 137 to 150 lbs. when compressed to 1 5/16". Discard springs which do not meet these specifications.

(2) Inspect each valve spring for squareness with a steel square and surface plate, test springs from both ends as shown in Fig. 15.

If the spring is more than 1/16" out of square, install a new spring.

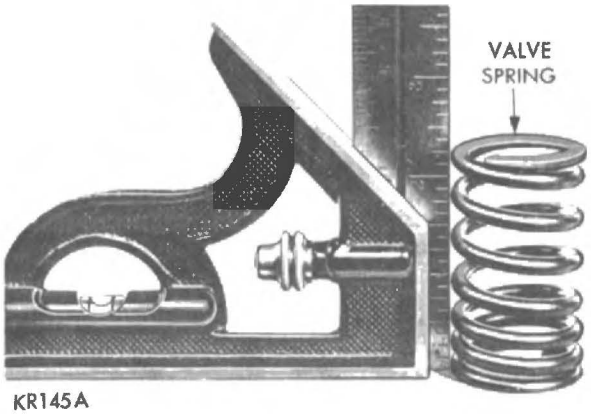


Fig. 15 - Checking valve spring squareness.

Installation

(1) Coat the valve stems with lubrication oil and insert them into cylinder head.

(2) Install new cup seals on all valve stems (long seal on intake valve and short seal on exhaust valve) and over valve guides (Figs. 16 and 17). Install valve springs and retainers. Install springs so that closed coils are against cylinder head.

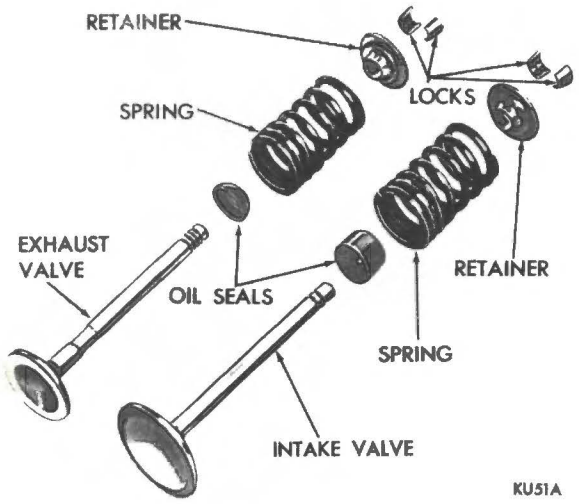


Fig. 16 - Valve assembly.

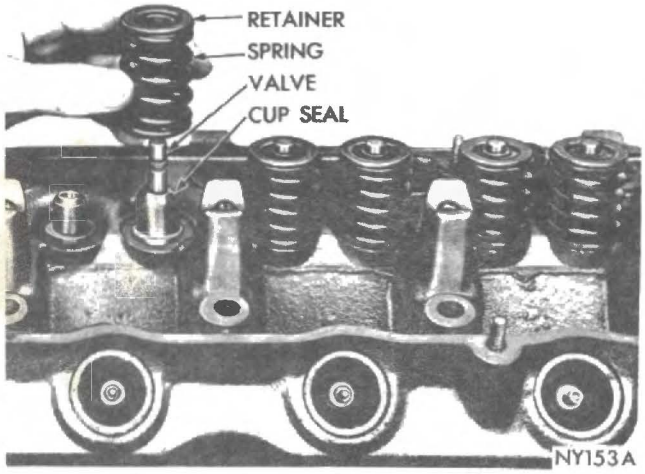


Fig. 17 - Installing valves and cup seals.

(3) Compress the valve springs with Tool C-3422, install locks and release tool.

If the valves and/or seats are re-ground measure the installed height of springs. Make sure measurement is taken from the bottom of the spring seat in cylinder head to the bottom surface of spring retainer. (If spacers are installed, measure from the top of spacer). If height is greater than 1 11/16" install a 1/16" spacer in head counterbore to bring spring height back to normal 1 5/8" to 1 11/16".

8. CHECKING VALVE TIMING

(1) Rotate the crankshaft until number 6 exhaust valve is closing and number 6 intake valve is opening. Install dial indicator so that the indicator pointer contacts the valve spring retainer on number one intake valve parallel to the axis of the valve stem.

(2) Turn number one intake adjusting screw in one complete turn to remove lash. Adjust the dial indicator to zero. Rotate the crankshaft clockwise (normal running direction) until the valve has lifted .018". The timing of the crankshaft pulley should now read from 12 degrees before top dead centre to dead centre. Re-adjust lash.

(3) If the reading is not within the specified limits:

(a) Check sprocket index marks.
(b) Inspect timing chain for wear.
(c) Check accuracy of D. C. mark on timing indicator.

9. TIMING SPROCKETS AND CHAIN

Removal

(1) Drain the cooling system.

(2) Remove radiator and fan.

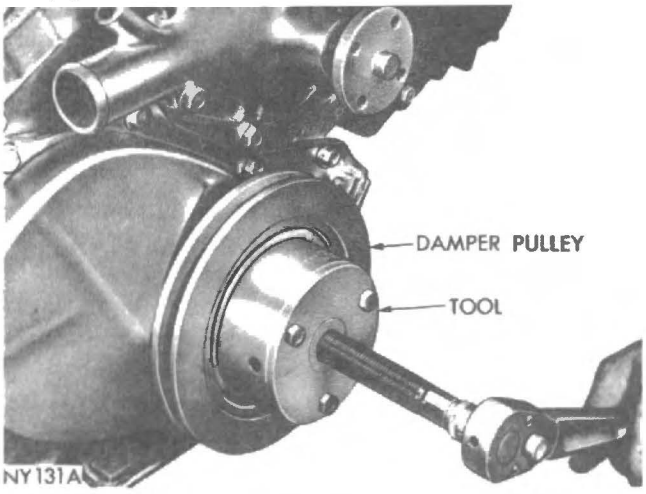


Fig. 18 - Removing damper pulley assembly (Tool CA-3732).

(3) Install Tool C-3732 and pull the vibration damper assembly off the end of the crankshaft (Fig. 18).

(4) Loosen oil pan bolts to allow clearance and remove the chain case cover and gasket.

(5) Slide the crankshaft oil slinger off the end of the crankshaft.

(6) Remove the crankshaft sprocket attaching bolt.

(7) Remove the timing chain with camshaft sprocket.

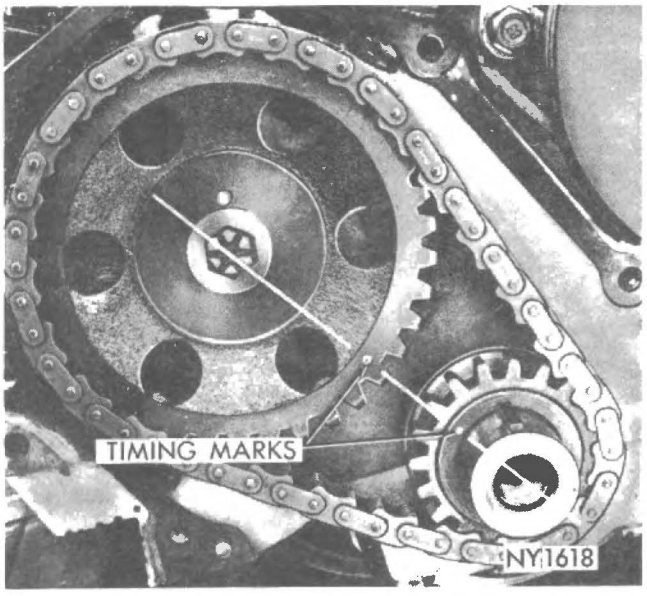


Fig. 19 - Alignment of timing marks.

Installation

(1) Turn crankshaft to line up centreline of camshaft and crankshaft with the timing mark on crankshaft sprocket.

(2) Install camshaft sprocket and timing chain.

(3) Line up the timing marks on the sprockets with the centreline of the crankshaft and camshaft (Fig. 19).

(4) Tighten the camshaft sprocket lock bolt to 35 lbs./ft.

Checking Timing Chain For Stretch

(1) Place a scale next to timing chain so that any movement of chain may be measured.

(2) Place a torque wrench and socket over the camshaft sprocket lock bolt and apply torque in the direction of crankshaft rotation to take up the slack; 30 lbs./ft. (cylinder head installed) or 15 lbs./ft. (cylinder head removed).

With a torque applied to camshaft sprocket bolt, the crankshaft should not be permitted to move. It may be necessary to block the crankshaft to prevent rotation.

(3) Holding a scale with dimensional reading even with edge of a chain link, apply torque in the reverse direction 30 lbs./ft. (cylinder head installed) or 15 lbs./ft. (cylinder head removed) and note the amount of chain movement (Fig. 20).

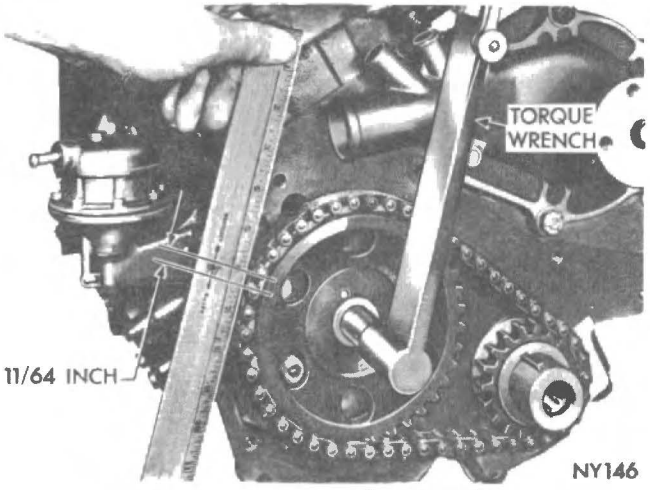


Fig. 20 - Measuring chain stretch.

(4) If chain movement exceeds 11/64" install a new timing chain.

(5) If chain is satisfactory, slide the crankshaft oil slinger over shaft and up against the sprocket (flange away from sprocket).

10. TIMING CHAIN CASE COVER OIL SEAL REPLACEMENT

Removal

NOTE: It is normal to find particles of neoprene collected between the seal retainer and crankshaft oil slinger after seal has been in operation.

(1) Position puller screw of Tool CA-3506 through cover, the inside of cover up. Position the puller blocks directly opposite each other, and force the angular lip between neoprene and flange of the seal retainer.

(2) Place washer and nut on puller screw. Tighten the nut forcing blocks into gap to a point of distorting the seal retainer lip (Fig. 21). Puller is only positioned at this point.

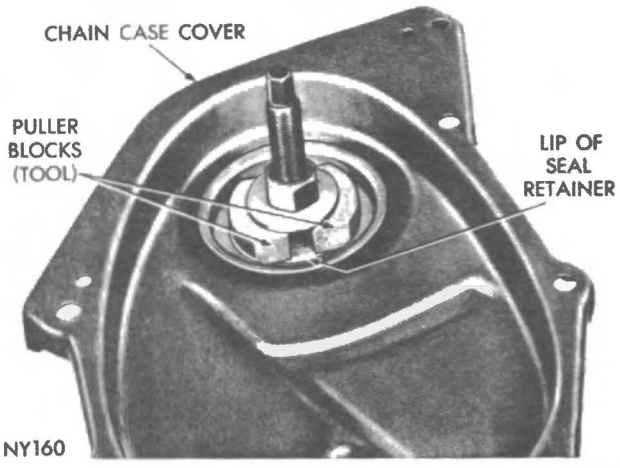


Fig. 21 - Puller blocks expanded to puller position (Tool CA-3506).

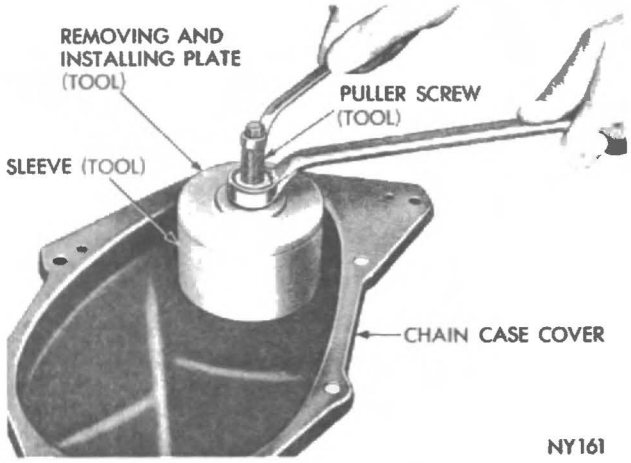


Fig. 22 - Removing oil seal (Tool CA-3506).

(3) Place sleeve over retainer and place removing and installing plate into sleeve.

(4) Place the flat washer and nut on puller screw. Hold the centre screw and tighten lock nut to remove seal (Fig. 22).

Installation of Oil Seal

(1) Insert puller screw through removing and installing plate so that the thin shoulder will be facing up.

(2) Insert puller screw with plate through the seal opening (inside of chain case facing up).

(3) Place the seal in cover opening, with neoprene down. Place the seal installing plate into the new seal, with protective recess toward lip of seal retainer (Fig. 23).

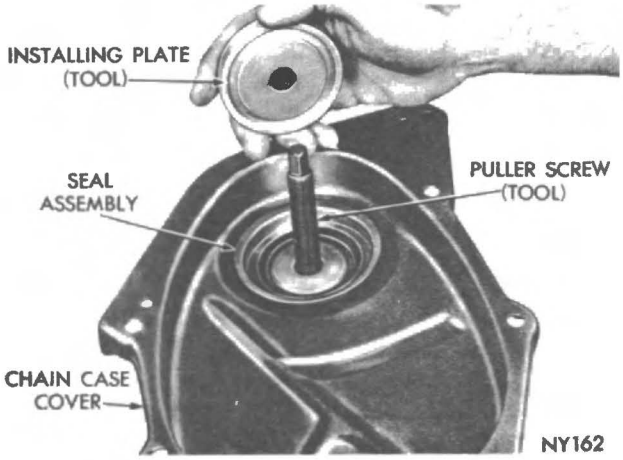


Fig. 23 - Positioning installer plate (Tool CA-3506).

(4) Install the flat washer and nut on puller screw; hold screw and tighten nut (Fig. 24).

(5) The seal is properly installed when neoprene is tight against the face of cover. Try to insert a .0015" feeler gauge between neoprene and cover, (Fig. 25) if the seal is properly installed, the feeler gauge cannot be inserted.

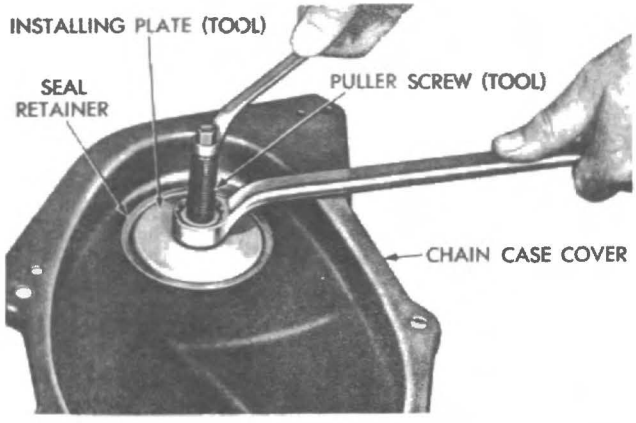


Fig. 24 - Installing new seal (Tool CA-3506). 60x163

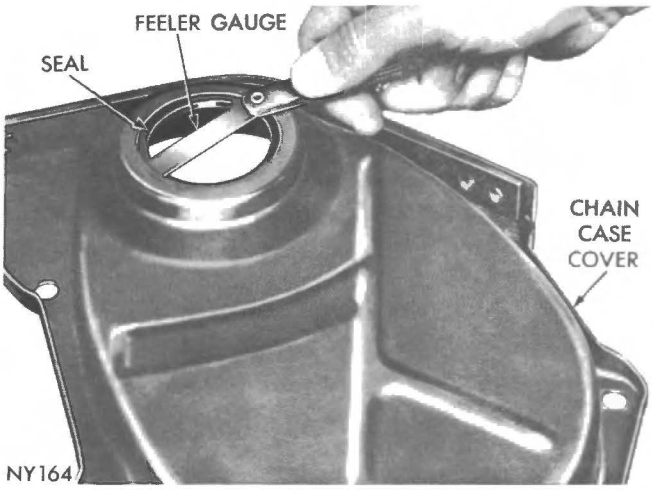


Fig. 25 - Checking seal for correct seating.

Installing Timing Chain Cover

(1) Ensure that the mating surfaces of timing chain cover and cylinder block are clean and free from burrs.

(2) Using a new gasket, slide the timing cover over the locating dowels and tighten bolts to 15 lbs./ft. Make sure all oil pan gaskets are in place and tighten oil pan bolts to 200 lb./in.

Installing Vibration Damper and Pulley Assembly

(1) Place the damper pulley assembly hub key in slot in crankshaft, and slide hub on crankshaft.

(2) Place the installing tool, part of puller set Tool CA-3732 in position and press the damper pulley assembly on the crankshaft (Fig. 26).

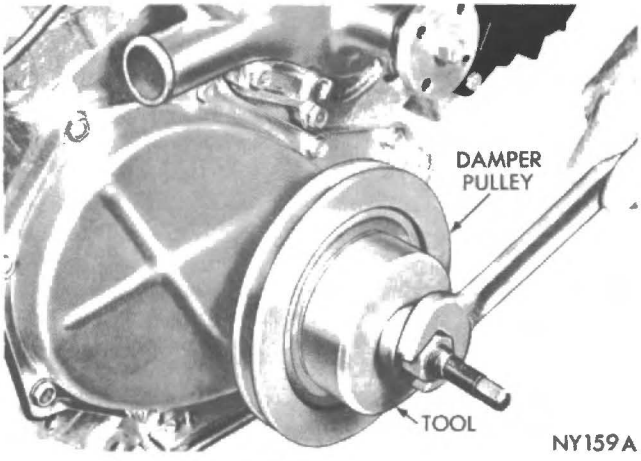


Fig. 26 - Installing damper pulley assembly (Tool CA-3732).

11. CAMSHAFT

The camshaft has an integral oil pump and distributor drive gear, and fuel pump eccentric, as shown in Fig. 27. Rearward camshaft thrust is taken by the rear face of the cast iron camshaft sprocket hub, bearing directly on the front of the cylinder block, eliminating the need for the thrust plate. The helical oil pump distributor drive gear and the camshaft lobe taper, both tend to produce only a rearward thrust.

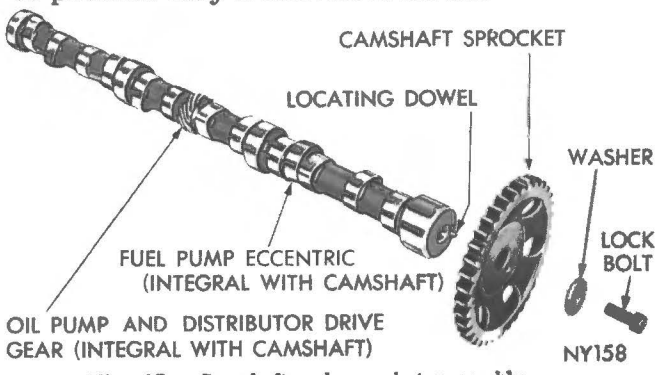


Fig. 27 - Camshaft and sprocket assembly.

Removal

(1) Remove the tappets using Tool C-3361.

(2) Remove timing sprocket, distributor and oil pump.

(3) Remove the fuel pump.

(4) Remove the camshaft, being careful not to damage the cam bearing with the cam lobes.

Installation

(1) Lubricate the camshaft lobes and camshaft bearing journals and insert the camshaft in the cylinder block (Fig. 28).

NOTE: Whenever an engine is rebuilt and a new camshaft and/or new tappets are installed, the sump should be filled to correct level with a premium grade oil of recommended viscosity. When replacing camshaft, all of the tappet faces must be inspected for crown with a straight edge. If any negative crown (dish) is observed, tappet must be replaced. Tappet must have a definite crown.

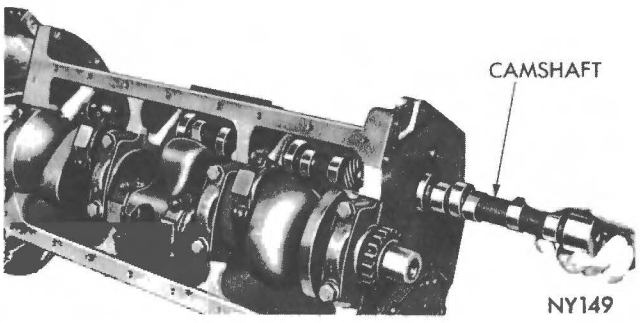


Fig. 28 - Installing camshaft.

Installation of Distributor

NOTE: The distributor rotates clockwise. Before installing the distributor, time the engine as follows:

(1) Rotate the crankshaft until mark on inner edge of crankshaft pulley is in line with the "O" (TDC) mark on timing chain cover. (No. 1 cylinder compression stroke).

(2) With distributor gasket in position, hold distributor over the mounting pad.

(3) Turn the rotor to point forward, corresponding to 4 o'clock.

(4) Install distributor so that when fully seated on engine, the gear has spiralled to bring rotor to a 5 o'clock position.

(5) Turn the housing until the ignition points are separating and rotor is under No. 1 cap tower.

(6) Install hold down bolt and connect primary wire.

(7) Adjust timing to specification, using a timing light. Connect vacuum line.

12. REMOVAL AND INSTALLATION OF CAMSHAFT BEARINGS (ENGINE REMOVED FROM CAR)

Removal

(1) With the engine completely disassembled, drive out the rear cam bearing welch plug.

(2) Install correct size adapters and horseshoe washers (part of Tool C-3132A) at back of each bearing shell to be removed, and drive out all the bearing shells.

Installation

(1) Install the new camshaft bearings with Tool C-3132A by sliding the new camshaft bearing shell over the correct adapter.

(2) Position bearing in the tool. Install horseshoe lock and drive bearing shell into place (Fig. 29).

The camshaft bearing oil hole must be in exact alignment with the drilled oil passage from the main bearing.

(3) Install remaining shells in like manner.

Install No. 1 camshaft bearing 3/32" inward from front face of the cylinder block.

(4) Use Tool C-897 to install new welch plug at the rear of camshaft.

Be sure that this plug does not leak.

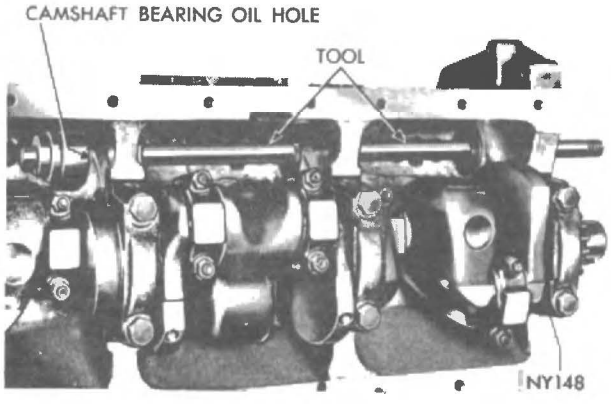


Fig. 29 - Removing and installing camshaft bearings (Tool C-3212A).

13. CYLINDER BLOCK

(1) Remove the top ridge of cylinder bores using Tool C-3012 before removing pistons from the cylinder block.

Keep the tops of the pistons covered during this operation.

(2) Pistons and connecting rods must be removed from the top of cylinder block. Rotate crankshaft so that each connecting rod is centred in the cylinder bore.

(3) Remove connecting rod cap.

(4) Install Tool CA-3221 on one connecting rod bolt and protector over the other bolt. Push each piston and rod assembly out of cylinder bore. Be careful not to nick the crankshaft journals.

(5) Install bearing caps on mating rods.

Inspection of Cylinders

The cylinder walls should be checked for out of round and taper with Tool C-119. If the cylinder bores show more than .005" out of round, or a taper of more than .010" or if the cylinder walls are badly scuffed or scored, the cylinder block should be rebored and honed, and new pistons and rings fitted. Whatever type of boring equipment is used, boring and honing operation should be closely co-ordinated with the fitting of pistons and rings in order that specified clearances may be maintained.

Honing Cylinder Bores

Before honing, pack plenty of clean rags under the bores, over the crankshaft, to keep the abrasive materials from entering the crankcase area.

(1) Used carefully, the cylinder bore resizing hone C-283 equipped with 220 grit stones, is the best tool for this job.

In addition to deglazing, it will reduce taper and out-of-round as well as removing light scuffing, scoring or scratches. Usually a few strokes will clean up a bore and maintain the required limits.

(2) Deglazing of the cylinder walls may be done using a cylinder surfacing hone, Tool C-3501 equipped with 280 grit stones (C-3501-3810). 20-60 strokes depending on bore condition will be sufficient to provide a satisfactory surface. Inspect cylinder walls after each 20 strokes. Use a light honing oil. Do not use engine or transmission oil, mineral spirits or kerosene.

(3) Honing with Tool C-3501 should be done by moving the hone up and down fast enough to produce a cross-hatch pattern. When hone marks intersect at 60°, the cross-hatch angle is most satisfactory for proper seating of rings (see Fig. 30).

(4) After honing, it is necessary that the block be cleaned again to remove all traces of abrasives.

CAUTION: Be sure all abrasives are removed from engine parts after honing. It is recommended that a solution of soap and water be used with a brush and the parts thoroughly dried. The bore can be considered clean when it can be wiped clean with a white cloth and cloth remains clean. Oil bores after cleaning to prevent rusting.

14. PISTONS

The pistons are cam ground so that the diameter at the pin boss is less than its diameter across the thrust face. This

Fig. 30 - Cross hatch pattern.

allows for expansion under normal operating conditions. The expansion forces the pin bosses away from each other, and the piston assumes a more round shape. Check pistons for taper and elliptical shape before they are fitted into the cylinder bores (see Fig. 31).

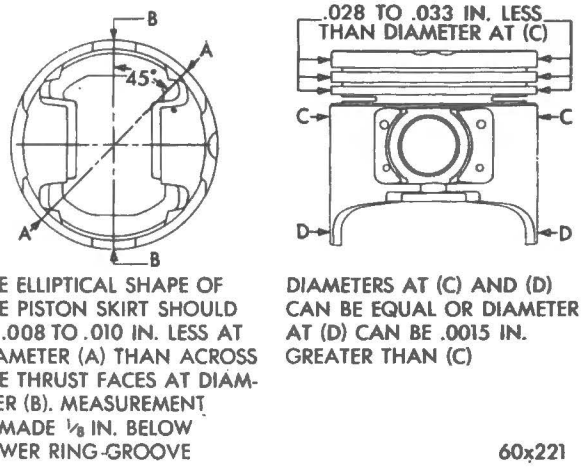


Fig. 31 - Piston measurement.

Finished Pistons

All pistons are machined to the same weight in grams, regardless of oversize to maintain piston balance. For cylinder bores which have been honed or rebored, all service pistons include pins and are available in standard and the following oversizes: .005", .020", .040".

Fitting Pistons

The piston and cylinder wall must be clean and dry. The specified clearance between the piston and the cylinder wall is .0005" to .0015".

(1) Pistons and cylinder bores should be measured at normal room temperature, 70 degrees F.

(2) Measure the piston diameter at the top of skirt 90 degrees to the piston pin axis.

(3) Measure the cylinder bores half way down the bore and transverse to the engine crankshaft centre line.

Fitting Piston Rings

(1) Measure the piston ring gap about two inches from bottom of cylinder bore in which it is to be fitted. (An inverted piston can be used to push the rings down to ensure positioning them squarely with the cylinder wall).

(2) Insert the feeler stock in gap. The ring gap should be .010" to .020" for compression rings, and .015" to .062" for the oil ring steel rails in standard size bores. Maximum gap in .005" oversize bores should be .040" for compression rings, and .070" for oil ring steel rails.

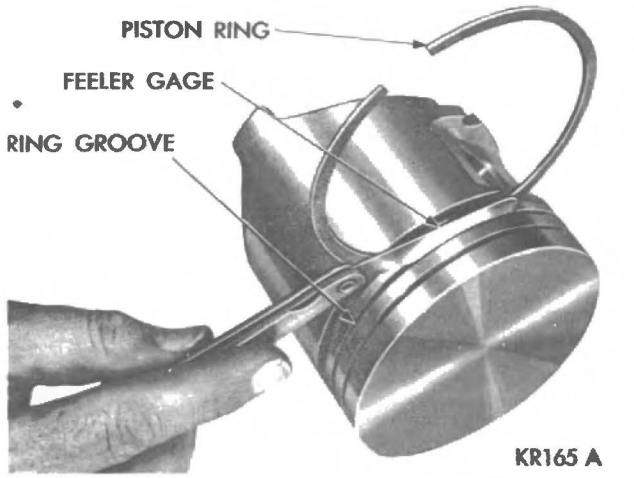


Fig. 32 - Measuring piston ring clearance.

(3) Measure the side clearance between piston ring and ring land (see Fig. 32). The clearance should be .0015" to .004" for the top compression ring and the intermediate ring, and .009" for the oil control ring.

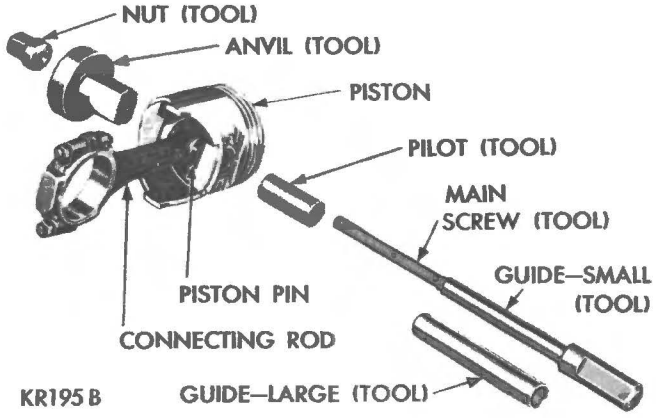


Fig. 33 - Tool arrangement for removing piston pin (Tool CA-3724).

(4) Starting with the oil ring expander, place expander ring in the lower ring groove and install oil control ring using instructions in package.

(5) Install the compression rings in middle and top grooves using ring installer, Tool C-3805. Ensure that the mark "TOP" on each compression ring is to the top of the piston.

15. PISTON PIN

To Remove

(1) Arrange Tool CA-3724 parts for the removal of piston pin (see Fig. 33).

(2) Install pilot on the main screw.

(3) Install the screw through the piston pin.

(4) Install anvil over the threaded end of the main screw with small end of anvil against the piston boss.

Be sure spring is removed from anvil.

(5) Install nut loosely on the main screw and place the assembly on press (Fig. 34) Press the piston pin out of connecting rod.

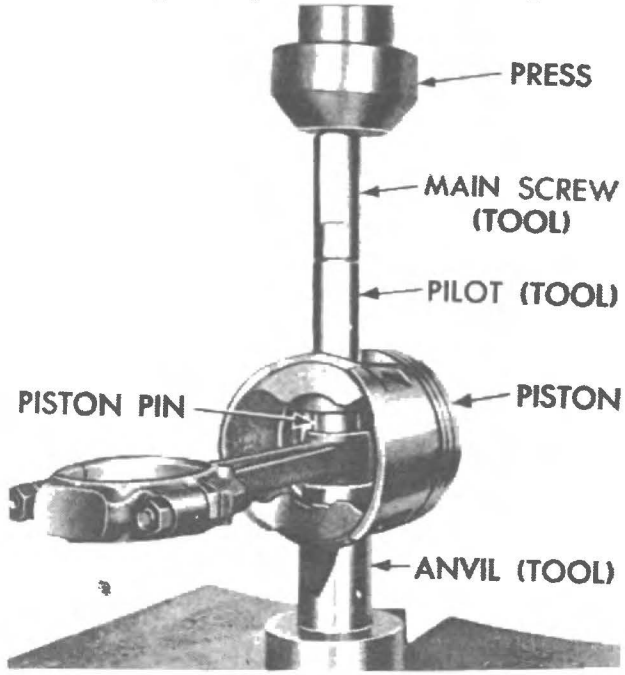


Fig. 34 - Removing piston pin (Tool CA-3724).

NOTE: When the pin falls free from connecting rod, stop the press to prevent damage to bottom of anvil. -

(6) Remove the tool from piston.

Installation

(1) Check the piston pin fit in the piston. It should be a sliding fit in the piston at 70° F. Piston pins are supplied in standard sizes only.

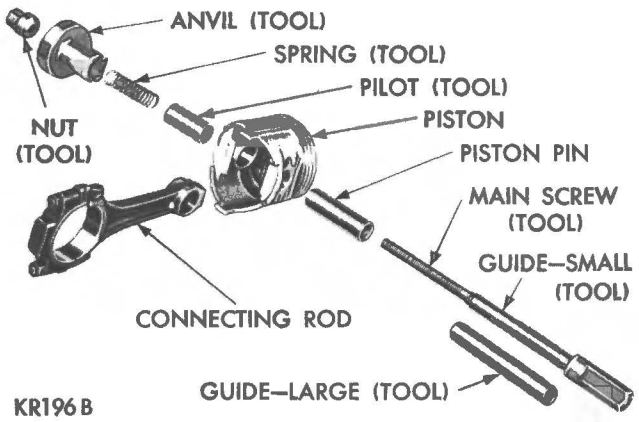


Fig. 35 - Tool arrangement for installing piston pin (Tool CA-3724).

(2) Lubricate the piston pin holes in the piston and connecting rod.

(3) Arrange the tool parts for installation of piston pin (Fig. 35).

(4) Install the spring inside the pilot and install the spring and pilot in the anvil.

(5) Install the piston pin over main screw.

(6) Place piston, with "Notch Front" up, over pilot so that the pilot extends through the piston pin holes.

(7) Position connecting rod over the pilot which extends through the piston hole.

The oil hole in the connecting rod must point toward the direction shown in Fig. 36.

(8) Install the main screw and piston pin in the piston (Fig. 37).

(9) Install the nut on main screw to hold assembly together. Place assembly on a press (Fig. 37).

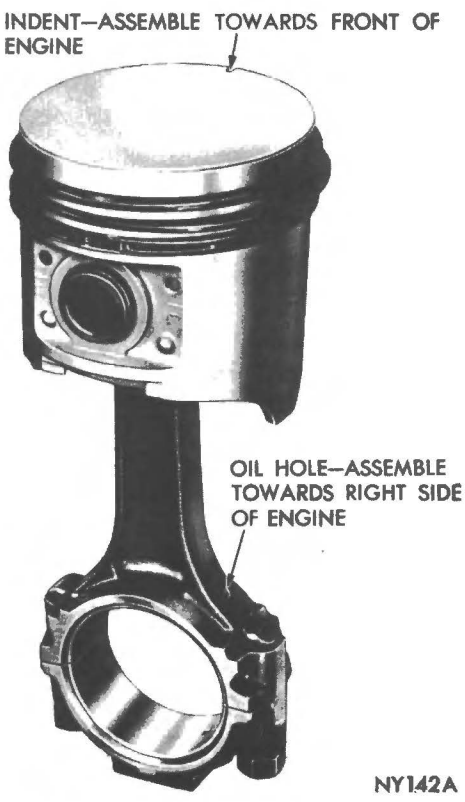


Fig. 36 - Connecting rod oil hole.

(10) Press in the piston pin until it bottoms on the pilot, correctly positioning the pin in the connecting rod.

(11) Remove the tool and arrange the tool parts and piston assembly in the same manner as shown in Fig. 33 for checking pin fit.

(12) Place assembly in a vice (Fig. 38).

(13) Attach the torque wrench to nut and check torque up to 15 lbs./ft. If the connecting rod moves downward on the piston pin, reject this connection rod and piston pin combination. Install a new connecting rod and repeat the installation and checking procedure. If the connecting rod does not move under 15 lbs./ft. torque, the piston and connecting rod interference is satisfactory.

(14) Remove the tool.

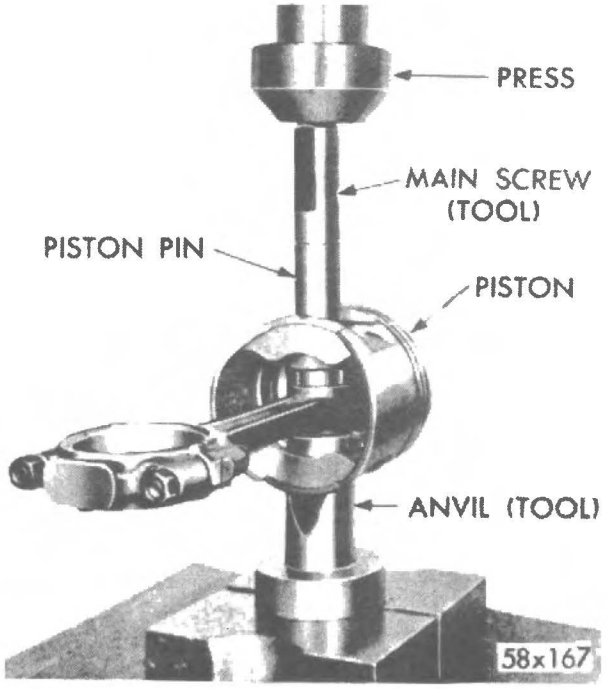


Fig. 37 - Installing piston pin (Tool CA-3724).

16. CONNECTING RODS

Installing Connecting Rod Bearings

(1) Install connecting rod bearings so that small formed tang fits into machined groove in connecting rod.

(2) Limits of taper or out-of-round on any crankshaft journal should be held to .001". Bearings are available in standard, .001", .002", .003", .010" and .012" undersize.

(3) Install the bearings in pairs.

Do not use a new bearing with an old bearing. Do not file the rods or bearing caps.

17. CHECKING THE CONNECTING ROD BEARING CLEARANCE

Plastigage Method

Connecting rod bearing clearance measurements can be made by the use of Plastigage with the engine in the chassis. After removing the connecting rod cap, wipe

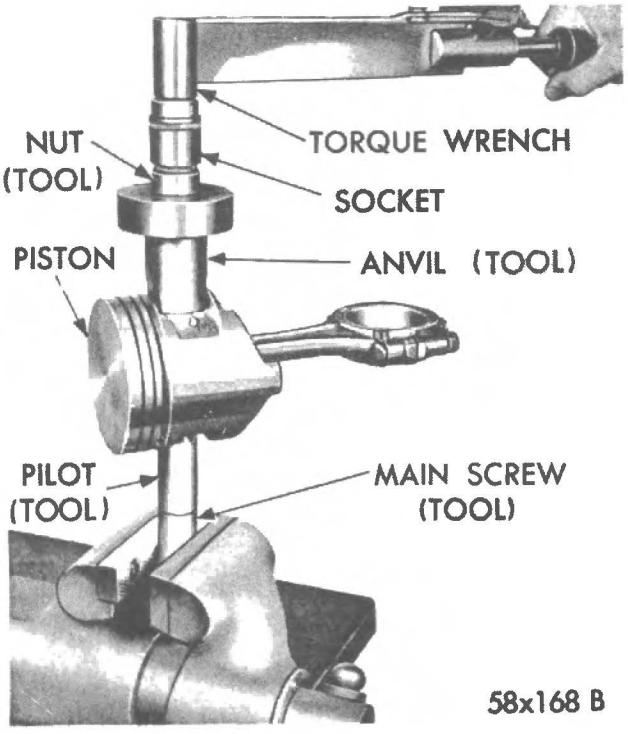


Fig. 38 - Testing fit of piston pin in connecting rod (Tool CA-3724).

off the oil from the crankpin journal and bearing inserts. Place the Plastigage on bearing parallel with crankshaft. Re-install the cap and tighten attaching nuts alternately to specified torque.

Remove cap and measure the width of the compressed material with the graduated scale to determine the bearing clearance. Desired clearance is from .0005" to .0015". If taper of the compressed material is evident, measure with graduated scale. If taper appears to exceed .005" the journal should be checked with a micrometer.

Shim Stock Method

(1) Place a piece of oiled .001" feeler stock ($\frac{1}{2}$" wide and $\frac{3}{4}$" long) between bearing and connecting rod journal.

(2) Install bearing cap and tighten to 45 lbs./ft.

(3) Turn connecting rod $\frac{1}{4}$ turn in each direction. A slight drag should be felt which indicates clearance is satisfactory. The correct clearance is from .0005" to .0015".

(4) The side play should be from .006" to .012".

Installing Piston and Connecting Rod Assembly in Cylinder Block

(1) Compression ring gaps should be located on the left side of the engine and staggered about 60° apart. Neither gap should line up with the oil ring rail gaps.

(2) Rotate oil expander so that the ends are at the right side of the engine. Rotate steel rails so that the gaps are approximately opposite and positioned above the piston pin holes.

(3) Immerse the piston head and rings in clean engine oil. Slide the ring compressor, Tool C-385, over the piston and tighten with special wrench (part of Tool C-385).

Position of rings must not change during this operation.

(4) The notch on the top of the piston must point toward the front of the engine. so that squirt hole in the connecting rod is toward the right side of the engine.

Identification numbers are stamped on the connecting rods on the same side as the squirt holes, so that the numbers are readily visible from the underside when the oil pan is removed.

(5) Screw the connecting rod bolt protector (part of Tool CA-3221) on one rod

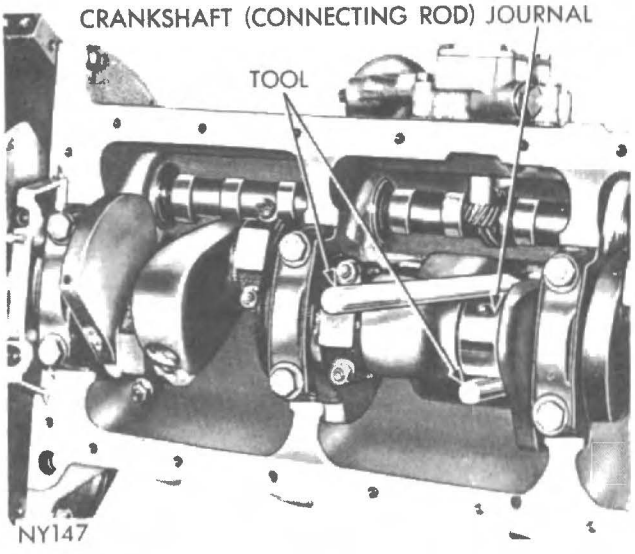


Fig. 39 Removing and installing connecting rod (Tool CA-3221).

bolt, and insert the rod and piston into cylinder bore.

Rotate the crankshaft so that connecting rod journal is on centre of cylinder bore.

(6) Attach the puller part of Tool CA-3221 on the other bolt, and guide the rod over the crankshaft journal (Fig. 39). Be careful not to nick the connecting rod journals.

(7) Tap piston down in cylinder bore, using the handle of a hammer. At the same time guide connecting rod into position on crankshaft journal.

(8) Install the rod caps, tighten nuts to 45 lbs./ft.

18. CRANKSHAFT MAIN JOURNALS

The crankshaft journals should be checked for excessive wear, taper and scoring. Journal grinding should not exceed .012" under the standard journal diameter. Do not grind the thrust faces of No. 3 main bearing. Do not nick the connecting rod or main bearing journal fillets. After regrinding, remove the rough edges from crankshaft oil holes and clean out all oil passages.

19. CRANKSHAFT MAIN BEARINGS

The Nos. 1, 2 and 4 lower main bearings are interchangeable (Fig. 40). The Nos. 2 and 4 upper main bearings are interchangeable.

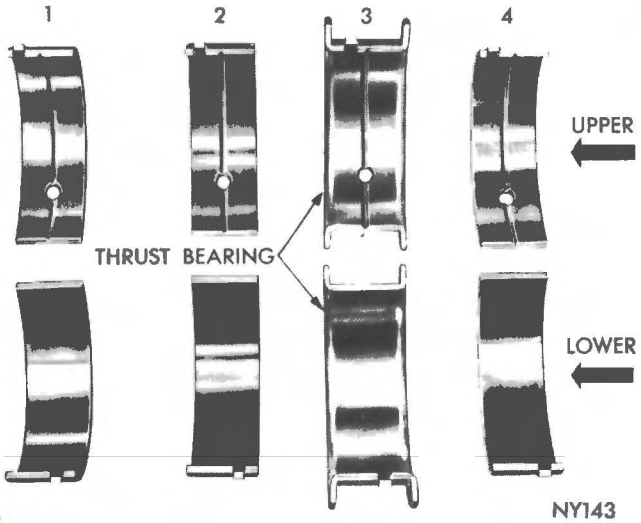


Fig. 40 - Main bearing identification.

The No. 1 upper main bearing is not interchangeable and is chamfered on the tab side for timing chain oiling and can be identified by a red marking on edge of bearing. Upper main bearings are grooved and lower main bearings are plain and are not interchangeable. The No. 3 upper and lower main bearings are flanged to carry the crankshaft thrust loads and are not interchangeable with any other main bearings in the engine.

Bearings that are not badly worn or pitted should be reinstalled in the same bearing bore.

The bearing caps are not interchangeable and numbers should be checked at removal to ensure correct assembly. Bearings are available in standard and the following undersizes: .001", .002", .003", .010" and .012". Never install an undersize bearing that will reduce the clearance below specifications.

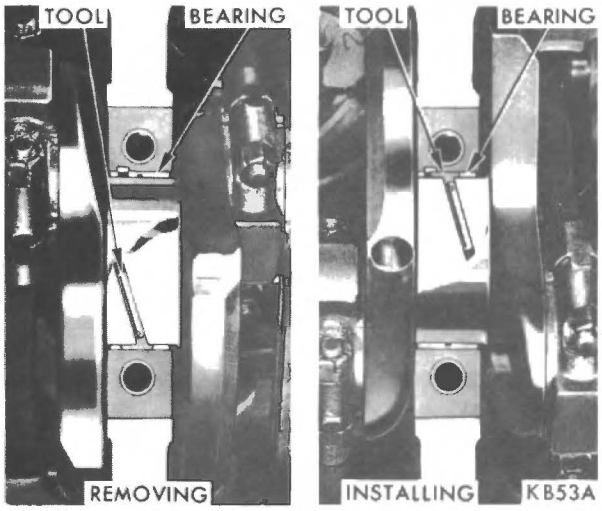


Fig. 41 - Removing and installing upper main bearings (Tool C-3059).

To Remove

(1) Remove the oil pan and check the bearing cap numbers.

(2) Remove bearing caps one at a time. Remove upper bearing by inserting Tool C-3059 (see Fig. 41) into the oil hole on crankshaft.

(3) Slowly rotate crankshaft clockwise, forcing out upper bearing.

20. CHECKING THE MAIN BEARING CLEARANCE

Plastigage Method

Use the same technique described in "Checking the Connecting Rod Bearing Clearance".

CAUTION: If bearings are measured with the engine in the chassis, the crankshaft must be supported in order to take up clearance between the upper bearing insert and the crankshaft journal. This can be done by snugging bearing caps of the adjacent bearings with a strip of .005" to .015" cardboard between lower bearing and journal. Use extreme caution when this is done to avoid unnecessary strain on the crankshaft or bearings, or false readings may be obtained. Do not rotate the crankshaft whilst plastigage is installed. Be sure to remove cardboard before re-installing oil pan.

It is permissable to use one .001" undersize bearing shell with one standard bearing shell, or one .002" undersize bearing shell with one .001" undersize shell. Always use the smaller diameter bearing half as the upper. Do not use a new bearing with a used bearing, and never use an upper bearing half more than .001" smaller than the lower bearing half.

Shim Stock Method

(1) Position crankshaft in block.

(2) Smooth the edges of a $\frac{1}{2}$ x 1 inch piece of soft copper or brass shim stock, .001" in thickness.

(3) Lubricate the main bearing journals and position the shim stock across the centre main journal.

(4) Install bearing in centre main bearing cap, bearing tang in groove on cap, lubricate bearing, and seat cap on block. Tighten bolts to 85 lbs./ft.

(5) If a slight drag is felt as the crankshaft is rotated, the clearance is .001" or less and is considered satisfactory. If however, no drag is felt, the bearing is too large; or if the crankshaft cannot be rotated the bearing is too small and should be replaced with the correct size.

(6) Check crankshaft end play. This should be .002" to .007". If end play is more than .007", install a new bearing.

(7) Fit the remaining bearings in a similar manner.

21. REPLACEMENT OF THE REAR MAIN BEARING OIL SEAL — (CRANKSHAFT REMOVED)

Cylinder Block

(1) Install a new oil seal in the cylinder block so that both ends protrude.

(2) Tap seal down into position, using Tool CA-3743 (with bridge removed) until the tool is seated in bearing bore.

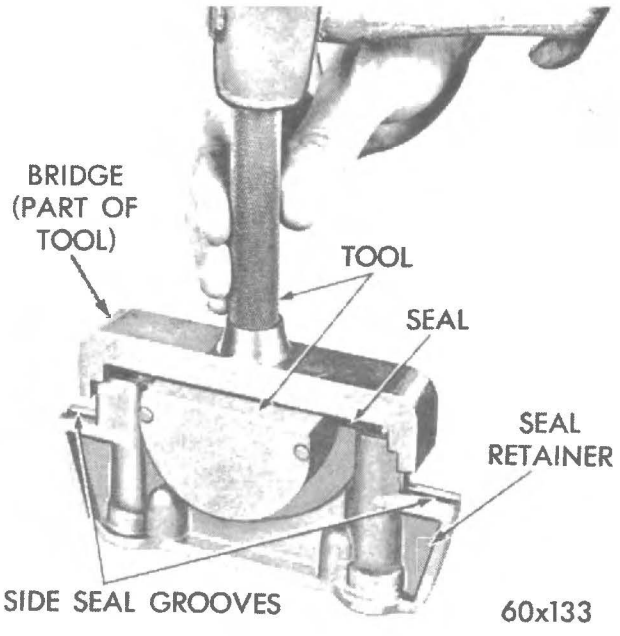


Fig. 42 - Installing rear main bearing oil seal (Tool CA-3743).

(3) Hold tool in this position and cut off portion of seal that extends above the block on both sides.

Bearing Cap

(1) Install a new seal in the seal retainer so that the ends protrude (Fig. 42)..

(2) Install bridge on tool and tap the seal down into the position until tool is seated.

(3) Trim off the portion of the seal that protrudes above the cap (Fig. 43).

(4) Install the two side seals in grooves in seal retainer.

(5) When installing seal retainer tighten screws to 30 lb./ft.

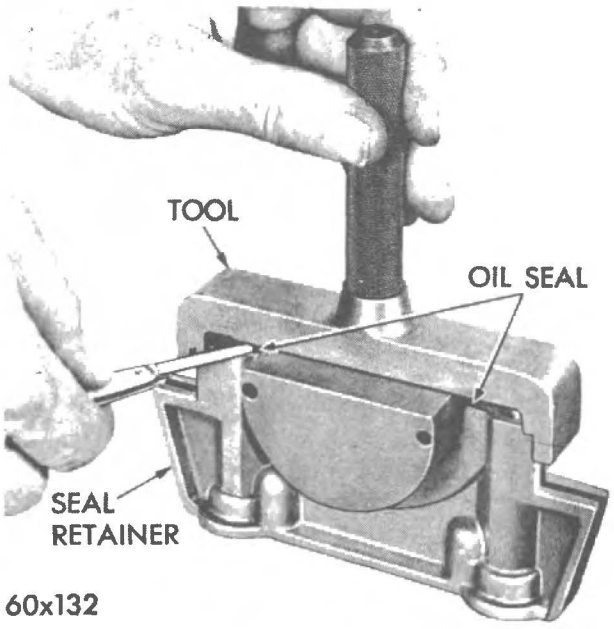


Fig. 43 - Trimming rear main bearing oil seal (Tool CA-3743).

PART 4

ENGINE OILING SYSTEM

SPECIFICATIONS

Crankcase capacity	6⅔ pints
With filter	8⅓ "
Oil filter	Replaceable
Oil pump:	
Drive	Camshaft
Operating pressure @ 40 - 50 m.p.h.	45 - 60 lb.
Type	Rotary - full pressure
Pressure drop resulting from clogged filter	7 - 9 lb.

TORQUE SPECIFICATIONS

Oil filter attaching stud	30 lb./ft.
Oil pan bolt	15 lb./ft.
Oil pan drain plug	35 lb./ft.
Oil pump attaching bolt	200 lb./in.
Oil pump cover bolt	130 lb./in.

SERVICE DIAGNOSIS

CONDITIONS — POSSIBLE CAUSES

1. **OIL PRESSURE DROP**

(1) Low oil level.

(2) Clogged oil filter.

(3) Worn parts in oil pump.

(4) Excessive bearing clearance.

(5) Thin or diluted oil.

(6) Oil pump relief valve stuck.

(7) Oil pump suction tube not aligned.

SERVICE INFORMATION—PROCEDURES

1. GENERAL INFORMATION

The engine oiling system consists of an externally mounted rotor type oil pump, and a full flow replaceable type oil filter. Oil is forced by the oil pump to a series of oil passages in the engine.

2. OIL PAN

To Remove

(1) Disconnect negative (ground) cable from battery.

(2) Drain cooling system and disconnect both radiator hoses.

(3) Loosen alternator adjusting strap and move alternator toward engine as far as possible.

(4) Disconnect throttle control at carburettor.

(5) Disconnect exhaust pipe at manifold.

(6) Disconnect any other tubes, hoses or wires in engine compartment that might interfere or be damaged by raising front of engine.

(7) Remove steering and idler arm ball joints from steering linkage centre link.

(8) Remove bolts attaching the two engine supports to the K member.

(9) Using a block of wood positioned under forward end of oil pan (over bolt heads), raise front end of engine approximately 2" with a jack against wood block.

Do not raise engine by jacking it up at vibration damper.

(10) After engine is raised, place short 4" x 2" wood blocks between engine supports and the K member then lower engine and remove jack.

(11) Remove clutch lower and front covers or converter plate.

(12) Drain oil and remove oil pan.

(13) Manoeuvre the oil pan forward then lower rear end of pan and remove.

(14) Note position of oil screen and pipe, and unscrew assembly from crankcase.

To Clean and Inspect

(1) Clean oil pan in solvent and wipe dry with a clean cloth.

(2) Scrape all gasket material from the mounting surface of pan and crankcase (see Fig. 1).

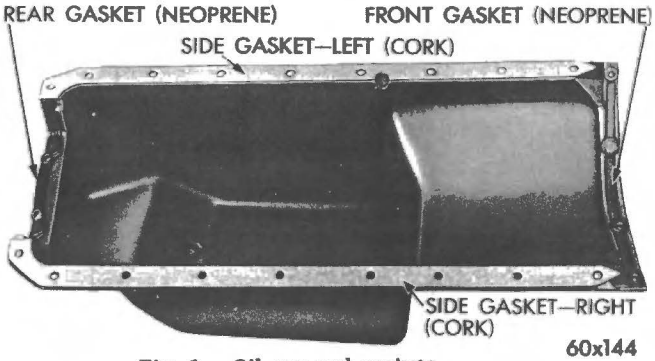


Fig. 1 - Oil pan and gaskets.

(3) Inspect oil drain plug and plug hole for stripped or damaged threads and repair as necessary. Install a new drain plug gasket.

(4) Inspect oil pan mounting flange for bends or distortion. Straighten flange if necessary.

(5) Clean oil screen and pipe thoroughly in clean solvent. Check condition of screen.

(6) Install oil screen and pipe. Turn in pipe until it begins to tighten in crankcase and continue tightening until screen is positioned (See Fig. 1A). Hold a steel rule against flat surface inside case and measure from edge of rule to edge of oil screen. Measurement should be $1\frac{1}{8}$" with screen correctly positioned.

To Install

(1) Using new pan gaskets, install oil pan and tighten bolts to 200 lb./in. in sequence (see Fig. 1B). Tighten Nos. 1, 12, 17 and 4 in this order, then either pan rail followed by remaining two cap screws at rear of pan, then four at front.

Fig. 1A - Positioning oil pick-up tube and screen.

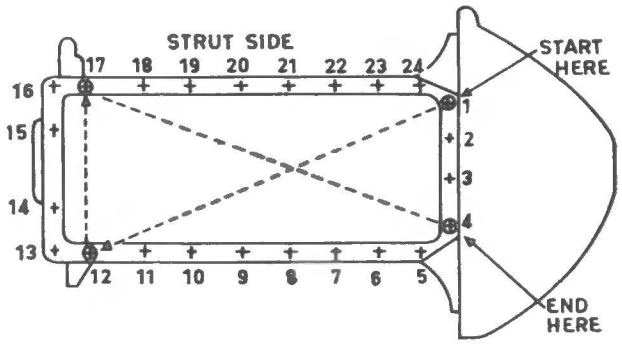


Fig. 1B - Sequence for tightening oil pan studs.

(2) Install lower and front clutch covers or converter cover plate.

(3) Position wood block under forward end of oil pan (over bolt heads), raise front end of engine with a jack.

(4) Remove wood blocks from under engine supports. Lower engine and install the two engine support to K member bolts. Tighten remaining nuts to 75 lb./ft.

(5) Connect steering and idler arm ball joints to centre link. Tighten retaining nuts to 40 lb./ft. and secure with cotter pins.

(6) Connect exhaust pipe to manifold. Connect throttle control to carburettor lever.

(7) Re-position alternator and adjust belt tension to $\frac{1}{4}$" deflection.

(8) Connect radiator hoses and fill cooling system.

(9) Connect battery cable and any other tubes, hoses, or wires that were disconnected.

(10) Fill with correct grade and quantity of engine oil.

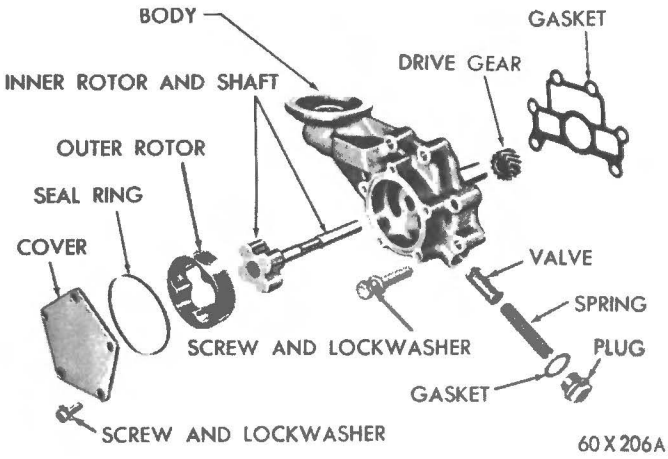


Fig. 2 - Oil pump (exploded view).

3. OIL PUMP

To Remove

(1) Disconnect negative (ground) cable from battery.

(2) Remove carburettor air cleaner.

(3) Disconnect carburettor linkage.

(4) Drain cooling system and remove radiator.

(5) Disconnect exhaust pipe at manifold.

(6) Remove distributor.

(7) Disconnect propeller shaft and tie out of way.

(8) Disconnect clutch linkage and release torque shaft ball as engine and transmission assembly is moved forward (manual transmission model).

(9) Disconnect speedometer cable.

(10) Disconnect gearshift linkage.

(11) Release wiring loom clips from tappet cover.

(12) Install engine lifting plate and take weight of engine.

(13) Remove NSF engine mount and remove bolts from O/S/F mount.

(14) Remove engine rear support cross-member.

(15) Raise engine and transmission assembly and move forward, then raise assembly sufficiently to enable pump to be removed.

(16) Remove oil pump.

To Disassemble

(1) Remove the pump cover and seal ring.

(2) Press off drive gear. Support the gear to keep load off aluminium body.

(3) Remove pump rotor and shaft and lift out the outer pump rotor.

(4) Remove oil pressure relief valve plug and lift out spring and plunger.

Inspection and Repair

(1) Clean all parts thoroughly. The mating face of the oil pump cover should be smooth. Replace cover if it is scratches or grooved.

(2) Lay a straight edge across the oil pump cover surface (Fig. 3). If a .0015" feeler gauge can be inserted between the cover and straight edge the cover should be replaced.

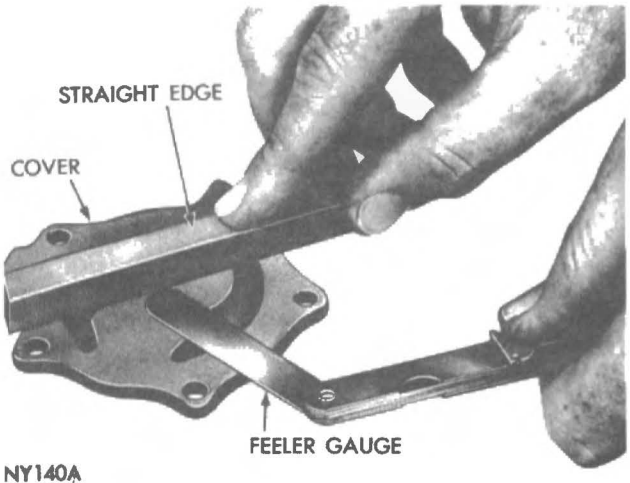


Fig. 3 - Checking oil pump cover flatness.

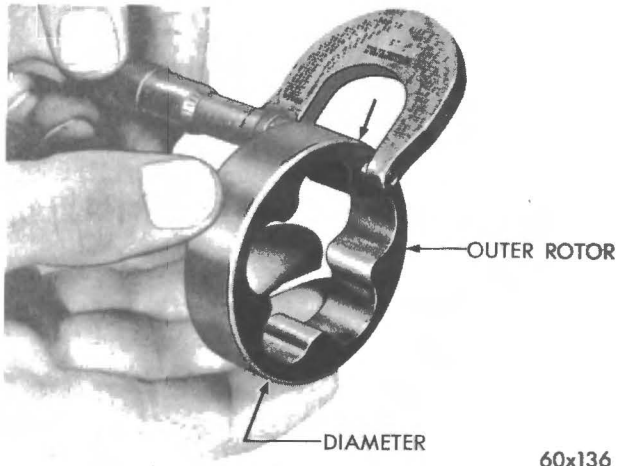


Fig. 4 - Measuring outer rotor thickness.

(3) If outer rotor length measures less than .649" (Fig. 4), and diameter less than 2.469", replace outer rotor.

(4) If inner rotor length measures less than .649" (Fig. 5), replace inner rotor.

(5) Slide outer rotor and inner rotor into pump body and place a straight edge across the face between the bolt holes (Fig. 6).

(6) If a feeler gauge of more than .004" can be inserted between rotors and straight edge, replace pump body.

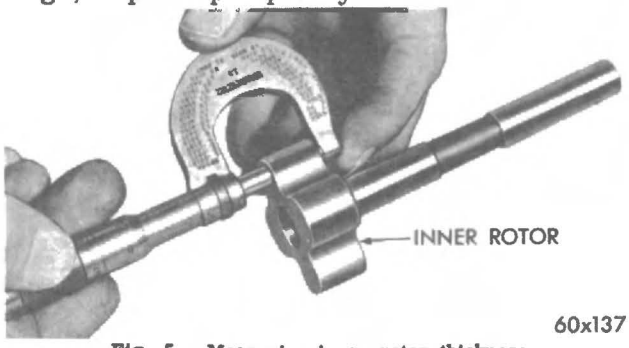


Fig. 5 - Measuring inner rotor thickness.

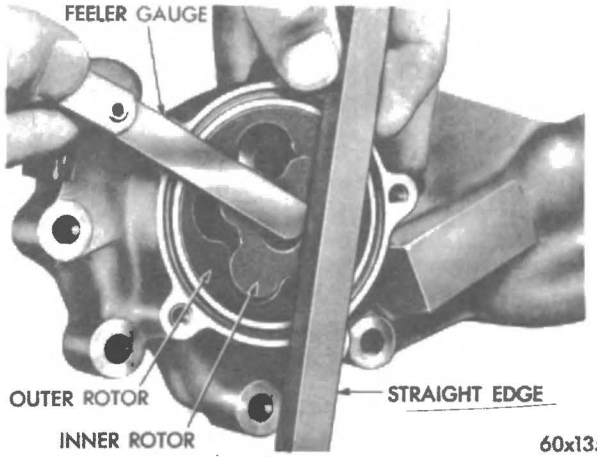


Fig. 6 - Measuring clearance over rotors.

(7) Remove inner rotor and shaft leaving the outer rotor in pump cavity.

(8) Press the outer rotor body to one side with fingers and measure the clearance between outer rotor and pump body. If measurement is more than .012" replace the oil pump body (see Fig. 7).

(9) If clearance between inner rotor and outer rotor is more than .010" (Fig. 8), replace inner and outer rotors.

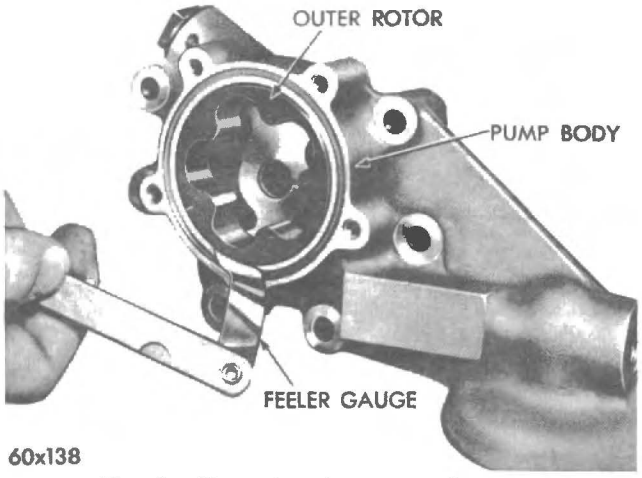


Fig. 7 - Measuring outer rotor clearance.

(10) Check the oil pump relief valve plunger for scoring and for free operation in its bore. If the plunger is scored, replace the plunger.

(11) The spring should conform to specifications on chart. If the spring is replaced, the same colour spring should be used. An exception is where oil pressure is either above or below specifications.

Relief Valve Spring Specifications

Colour	Free Length	Loaded Length	Compression Pounds.
Red (Std.)	2 19/64"	1 39/64"	@ 14.85 - 15.85

Assembly

(1) Assemble the pump, using new parts as required.

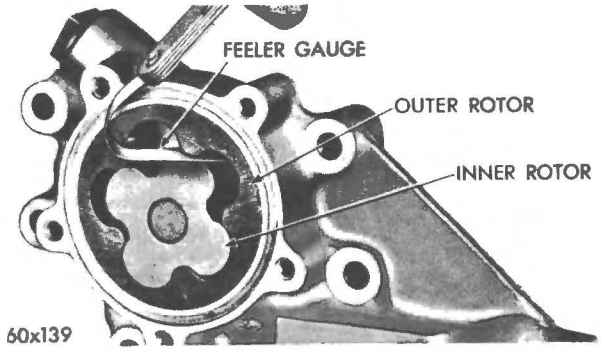


Fig. 8 - Measuring clearance between rotors.

(2) Install new oil seal rings between cover and body. Tighten bolts to 130 lb./in.

NOTE: Two types of oil pump covers have been used the later of which is marked with an arrow. Such covers should be installed with the arrow pointing upwards.

To Install

(1) Using a new gasket, install pump on engine and tighten bolts to 200 lb./in.

(2) Lower engine and transmission assembly into place and re-fit clutch torque shaft ball whilst this operation is being carried out (manual transmission).

(3) Re-fit rear engine support cross-member.

(4) Re-fit front engine mounts.

(5) Re-connect speedometer cable.

(6) Re-connect gearshift linkage.

(7) Re-connect clutch linkage.

(8) Re-connect propeller shaft.

(9) Replace distributor.

(10) Re-connect exhaust pipe to manifold.

(11) Re-connect carburettor linkage.

(12) Re-fit carburettor air cleaner.

(13) Replace wiring loom in clips on tappet cover.

(14) Remove engine lifting plate.

(15) Refill cooling system.

(16) Connect battery (negative) ground cable.

ENGINE

V8 CYLINDER

V8 CYLINDER

THE ENGINE ASSEMBLY

SPECIFICATIONS

ENGINE

Type	8 cylinder 90°V
Bore x Stroke	3.625" x 3.31"
Piston Displacement	273 cu. ins.
Compression Ratio	8.8:1
Compression Pressure (Plugs removed, wide open throttle)	120 - 150 p.s.i.
Maximum Variation Between Cylinders (any one engine)	20 p.s.i.

Cylinder Numbering:
(From driver's seat front to rear)

Left Bank	1-3-5-7
Right Bank	2-4-6-8

CYLINDER BLOCK

Cylinder Bore Out-of-round (Maximum allowable before reconditioning)	.005"
Cylinder Bore Taper (Maximum allowable before reconditioning)	.010"
Maximum allowable Oversize (Cylinder Bores)	.040"
Tappet Bore Diameter	.9050" to .9058"
Distributor Lower Drive Shaft Bushing:	
Bushing interference fit in block	.0005" to .0040"
Ream to	.4865" to .4880"
Shaft to Bushing Clearance	.0007" to .0027"

CAMSHAFT

Drive	Chain
End Play	.002" to .006"
Maximum allowable	.010"
Radial Clearance	.001" to .003"
Maximum Allowable	.005"
Thrust taken by	Thrust Plate

CAMSHAFT JOURNALS

Diameter	No.1 1.988" - 1.999"
	No.2 1.982" - 1.983"
	No.3 1.967" - 1.968"
	No.4 1.951" - 1.952"
	No.5 1.5605" - 1.5615"

CRANKSHAFT

Type	Fully Counter-Balanced
Bearings	Steel Backed Babbitt
Thrust taken by	No. 3 Main Bearing
End Play	.002" to .007"
Maximum allowable	.010"
Radial Clearance	.0005" to .0015"
Maximum allowable	.0025"
Finish at Rear Oil Seal Surface	Diagonal Knurling

MAIN BEARINGS (SERVICE)

Available in standard and the following undersizes	.001", .002", .003", .010", .012", .020", .030".

MAIN BEARING JOURNALS

Diameter	2.4995" - 2.5005"
Maximum allowable out-of-round and/or taper	.001"

CONNECTING ROD JOURNALS

Diameter	2.124" - 2.125"
Maximum allowable out-of-round and/or taper	.001"
Bearing Clearance Desired	.0005" to .0015"
Maximum Allowable	.0025"
Side Clearance (2 rods)	.006" - .014"
Bearings for Service	Std. .001", .002", .003", .010", .012", .020" and .030".

CONNECTING ROD BUSHING

Type	Steel Backed Bronze

PISTONS

Material	Aluminium-Alloy (Tin coated)
Clearance in bore (with .0015" x $\frac{1}{2}$" Feeler Strip)	5 - 10 lbs. pull
Land Clearance (in bore)	.029" - .034"
Clearance (top of skirt)	.0005" - .0015"
Pistons for Service	Std. .005", .020", .040" and O.S.

PISTON PINS

Type	Full floating
Diameter by Length	.9842" x 2.818"
Clearance in Piston (Light thumb push @ 70°F)	.0000" - .0005"
Clearance in Rod	.0000" - .0005"
Pins for Service	Std. .003", .008" O.S.

PISTON RINGS

Compression	2
Oil with Expander	1
Piston ring gaps (compression)	.010" - .020"
Piston ring gaps (steel rail)	.015" - .062"
Ring Side Clearance (Top)	.0015" - .003"
(Intermediate)	.0015" - .003"
(oil) (Service ring)	.001" - .009" Max.
Width (Compression)	.0775" - .0780"
(oil) (Steel Rails)	.025"

TAPPETS

Type	Mechanical
Body Diameter	.9040" - .9045"
Clearance in Block	.0005" - .0015"
Service Tappets available in standard and the following oversizes	Std. .001", .008" and .030"
Operating Clearance (hot)	.013" Intake, .021" Exhaust

VALVES — INTAKE

Head Diameter	1.780"
Length (to centre of valve face)	5.00"
Stem Diameter (Standard)	.372" - .373"
Stem to Guide Clearance	.001" - .003"
Maximum allowable (Wobble Method)	.016"
Face Angle	45°
Valves for Service	Std. .005", .015" and .030" (O.S. Stem diameter)
Lift	.395"

VALVES — EXHAUST

Head Diameter	1.500
Length (to centre of valve face)	5.00"
Stem Diameter (Standard)	.3715"
Stem to Guide Clearance	.002" - .004"
Maximum allowable (Wobble Method)	.018"
Face Angle	45°
Valves for Service	Std. .005", .015" and .030" (O.S. Stem diameter)
Lift	.405"

Valve Guides:

Type	Cast in Head
Guide Bore Diameter	.374" - .375"

VALVE SPRINGS

Free Length	1.92"
Load when compressed (Valve closed)	49-57 lbs @ 1 11/16"
" " " (Valve open)	137-150 lbs @ 1: 5/16"
Maximum out-of-square	1/16"
Valve Spring installed height (Spring Seat to Retainer)	1 5/8" - 1-11/16"

Use a 1/16" spacer to reduce spring height when over specification.

VALVE TIMING

Intake Opens (B.T.D.C.)	14°
Intake Closes (A.B.D.C.)	46°
Exhaust Opens (B.B.D.C.)	58°
Exhaust Closes (A.T.D.C.)	2°
Valve Overlap	16°
Intake Duration	240°
Exhaust Duration	240°

CYLINDER HEAD

Valve Seat Run-Out (Maximum)	.002"
Intake Valve Seat Angle	45°
Intake Valve Seat Width (finished)	.060" - .085"
Exhaust Valve Seat Angle	45°
Exhaust Valve Seat Width (finished)	.040" - .060"
Cylinder Head Gasket (Thickness compressed)	.028"

Rocker Shaft Assembly:

Clearance between rocker arm and shaft	.001" - .003"

ENGINE LUBRICATION

Pump Type	Rotary-Full Pressure
Pump Drive	Camshaft
Minimum Pump Pressure @ 500 RPM	20 p.s.i.
Operating Pressure @ 1,000 RPM	45 to 65 p.s.i.
Oil Filter Type	Full Flow

1. GENERAL INFORMATION

The new 273 cubic inch V-8 engine is a light weight highly efficient engine designed especially for Valiant to provide increased performance with the manoeuvrability of a compact car.

2. ROCKER ARMS AND SHAFT

Removal

(1) Remove the cylinder head cover and gasket.

(2) Remove the bolts that attach the rocker arm shaft to the cylinder head and remove the rocker arms and shaft as an assembly.

(3) If the rocker arm assemblies have been disassembled for cleaning, inspection or replacement, refer to Fig. 1 for proper reassembly.

Installation

(1) Install the rocker arm and shaft assemblies with the "NOTCH" on the end of the rocker shaft pointing to the centreline of the engine and toward the front of the engine on the left bank and to the rear of the right bank, making sure to install the long stamped steel retainers in the number two and four positions, tighten to 15 lbs/ft.

(2) Start the engine and run until normal operating temperature is reached.

(3) Adjust the tappets to .013 inch for intake and .021 for exhaust.

(4) Install the valve covers with new gaskets, tighten to 40 lbs/in. torque.

3. CYLINDER HEAD ASSEMBLY

Removal

(1) Drain the cooling system. Remove the carburettor air cleaner, fuel line, alternator and distributor vacuum line.

(2) Disconnect the throttle linkage, coil wires, heat indicator sending unit wire and heater hoses at the engine.

(3) Remove the distributor cap and the spark plug cables.

(4) Remove the intake manifold attaching bolts and remove the manifold, carburettor and coil as an assembly.

(5) Remove the cylinder head covers, closed vent system and exhaust manifolds.

(6) Remove the rocker arms and shaft assemblies, push rods and place them in their respective slots in holder, Tool CA-3068.

(7) Remove head bolts from each cylinder head and remove cylinder heads. Place cylinder heads in holding fixture, Tool C-3626.

Installation

(1) Inspect all surfaces with a straightedge if there is any reason to suspect leakage.

(2) Coat the new gaskets with a suitable sealer.

(3) Remove the cylinder heads from the holding fixtures Tool C-3626 and install on the engine.

(4) Install and tighten all head bolts starting at top centre, to 85 lbs/ft using the torque sequence, as shown in Fig. 2. Repeat the procedure, retightening all head bolts to 85 lbs/ft. torque.

(5) Install the small end of the push rods in the tappets.

(6) Install the rocker arm and shaft assembly starting each push rod into its respective rocker arm socket making sure to install the long stamped steel retainers in the number two and four positions.

(7) Coat the intake manifold gaskets

and side seals with suitable sealer and install the intake manifold gaskets with the bead down and the end seals locked in the tangs of the head gasket.

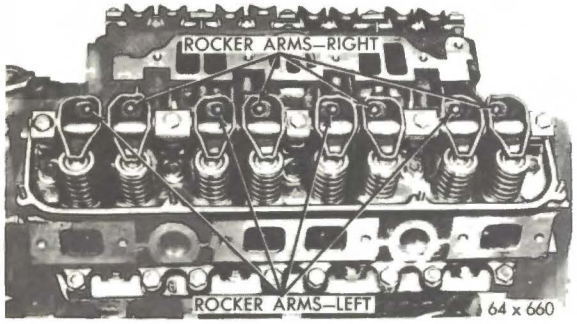


Fig. 1 Rocker Arm Assemblies Installed

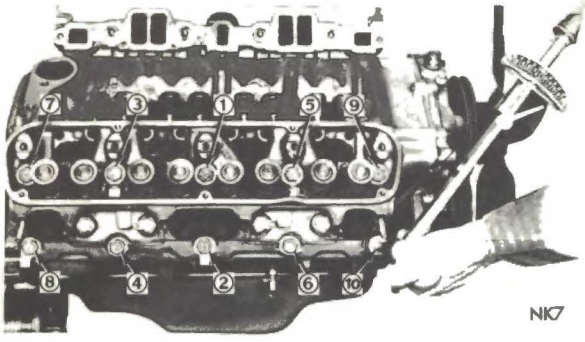


Fig. 2 Cylinder Head Tightening Sequence

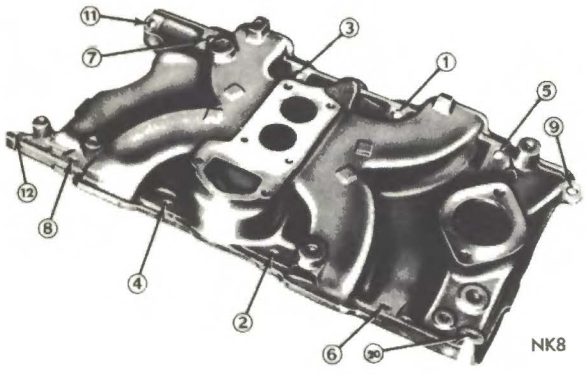


Fig. 3 Intake Manifold Tightening Sequence

(8) Position the intake manifold on the engine and install the twelve attaching cap screws "Finger Tight" in the tightening sequence shown in Figure 3. Tighten the cap screws one through four to 60 lbs/in and tighten the remaining cap screws to 60 lbs/in, then retighten cap screws one through four to 270 lbs/in and follow by retightening the remaining cap screws to 270 lbs/in. in the sequence shown.

(9) Install the exhaust manifolds, use new gaskets, tighten to 15 lbs/ft torque.

(10) Install the spark plugs with new gaskets, tighten to 30 lbs/ft. torque.

(11) Install the distributor cap and spark plug cables and the engine closed vent system.

Install the throttle linkage, coil wires, heat indicator sending unit wire, and the heater hoses.

Install the alternator, distributor vacuum line, fuel line, and carburettor air cleaner.

(12) Fill the cooling system. Start the engine and run until normal operating temperature is reached.

(13) Adjust the tappets to .013 inch for intake and .021 inch for exhaust. Install the valve covers with new gaskets, tighten to 40 lbs/in. torque.

4. VALVES AND VALVE SPRINGS

NOTE: Intake and exhaust valves operate in guides that are integral with the heads.

Removal

(1) With the cylinder head removed, compress the valve springs, using Tool C-3422A.

(2) Remove the valve retaining locks, valve spring retainers, valve stem cup seals and valve springs.

NOTE: Remove any burrs from the valve stem lock grooves to prevent damage to the valve guides when the valves are removed.

Valve Inspection

(1) Clean the valves thoroughly, and discard burned, warped and cracked valves.

(2) Measure the valve stems for wear. The new intake valve stem diameter should measure .372 to .373 inch and exhaust valve stem diameter should measure .371 to .372 inch. If the wear exceeds .002 inch, replace the valve.

(3) Remove the carbon and varnish deposits from the inside of the valve guides with cleaner, Tool C-756.

(4) Measure the valve stem guide clearance as follows: Install sleeve, Tool C-3973 over valve stem to hold valve at working height in head, as shown in Fig. 4.

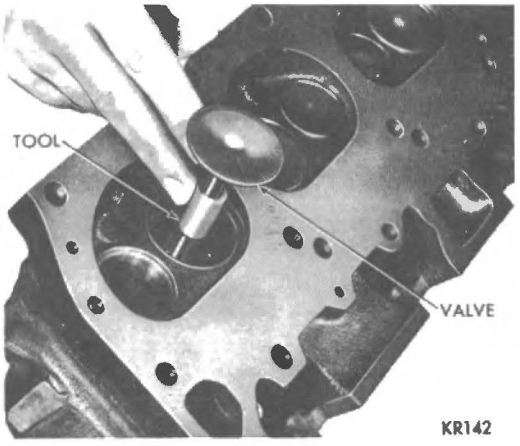


Fig. 4 Installing Tool C-3973 (Typical)

(5) The special sleeve places the valve at the correct height for measuring with a dial indicator. Attach the dial indicator, Tool C-3339 to cylinder head and set it at a right angle to the valve stem being measured (Fig. 5). Move valve to and from the indicator. Total movement should not exceed .016 inch on intake valves and .018 inch on exhaust valves.

(6) If the tolerance is excessive, ream guides and install valve with oversize stems. Reamer Tool CA-3433 will ream guides for .005 inch oversize valve stems. Tool CA-3430 for .015 inch oversize, Tool CA-3427 for .030 inch oversize. Turn reamer by hand, and clean guides thoroughly when finished. Use .005 inch reamer first and, if necessary, the .015 inch, then the .030 inch so the guides remain true in relation to the seat.

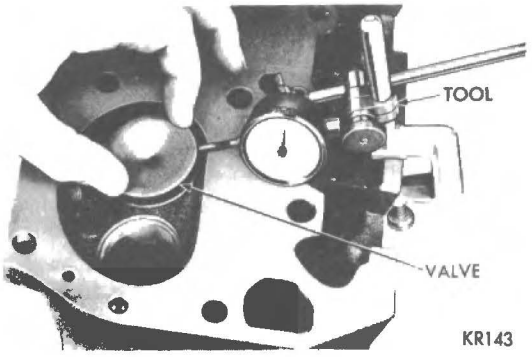


Fig. 5 Measuring Guide Wear Using Tool C-3339 (Typical)

Refacing Valves and Valve Seats

The intake and exhaust valve faces have a 45° angle. Always inspect the remaining margin after the valves are refaced (Fig. 6). Valves with less than 3/64 inch margin should be replaced.

(1) The angle of both valve and seat should be identical. When refacing the valve seats it is important that the correct size valve guide pilot be used for the reseating stones. A true and complete surface must be obtained.

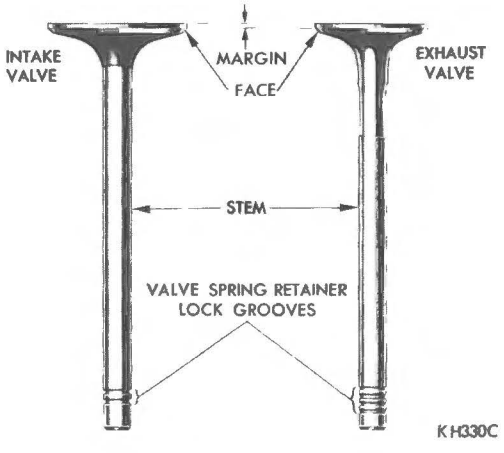


Fig. 6 Intake and Exhaust Valve Faces

(2) Measure the concentricity of the valve seat using a dial indicator. The total runout should not exceed .003 inch (total indicator reading).

(3) When the seat is properly positioned the width of the intake seats should be 1/16 to 3/32 inch. The width of the exhaust seats should be 3/64 to 1/16 inch.

(4) When the valves and seats are reground, the position of the valve in the cylinder head is changed, the valve stems will extend further out of the cylinder heads. This increased dimension will decrease valve spring compression.

(5) The design of the valve mechanism includes a safety factor to allow for a limited amount of wear, and the refacing of valves and seats.

(6) To ensure that the limits have not been exceeded, the dimension from valve spring seat in head to valve tip should be measured with gauge Tool C-3968, shown in Figure 7.

If the valve stem extends above the gauge, grind the end of the stem to fall between the maximum and the minimum.

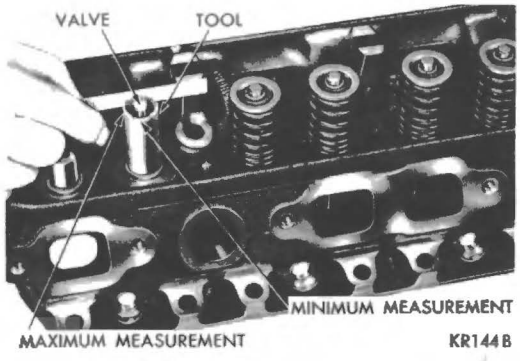


Fig. 7 Measuring Valve Stem Length (Typical)

Testing Valve Springs

(1) Whenever the valves have been removed for inspection, reconditioning or replacement, the valve springs should be tested. To test a spring determine the length at which the spring is to be tested.

As an example, the compressed length of the spring to be tested is 1 15/32 inches. Turn the table of Tool C-647 until the surface is in line with the 1 15/32 inch mark on the threaded stud and the zero mark to the front. Place spring over the stud on the table and lift the compressing lever to set the tone device. Pull on torque wrench until a ping is heard. Take the reading on torque wrench at this instant. Multiply this reading by two. This will give the spring load at the test length. Fractional measurements are indicated on the table for finer adjustments. The valve spring should test 49 to 57 pounds when compressed to 1 11/16 inches and 137 to 150 when compressed to 1 5/16 inches. Replace springs that do not meet specifications.

(2) Inspect each valve spring for squareness at both ends with a steel square and surface plate, as shown in Figure 8.

(3) If the spring is more than 1/16 inch out of square, install a new spring.

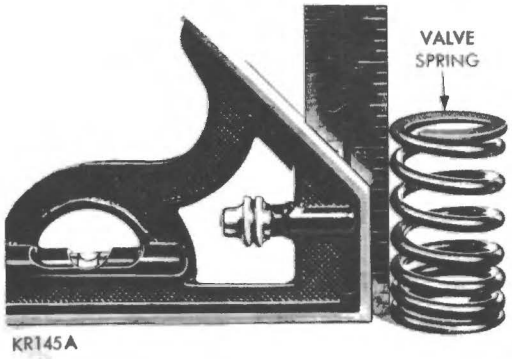


Fig. 8 Inspecting Valve Spring Squareness

Installation

(1) Coat the valve stems with lubricating oil and insert them in position in the cylinder head.

(2) Install new cup seals in the intake and exhaust valve stems and other valve guides, as shown in Figure 9 and 10 and install valve springs and retainers.

(3) Compress the valve springs with Tool C-3422A. Install locks and release tool.

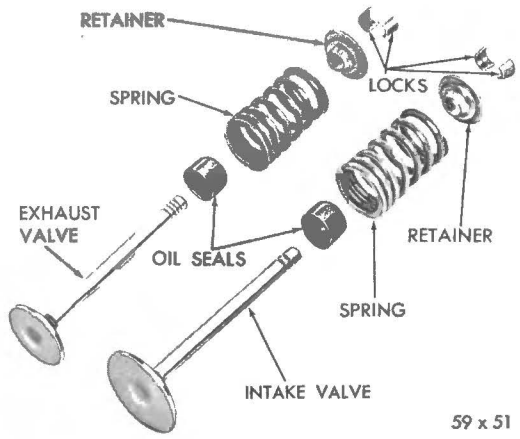


Fig. 9 Valve Assembly (Disassembled View)

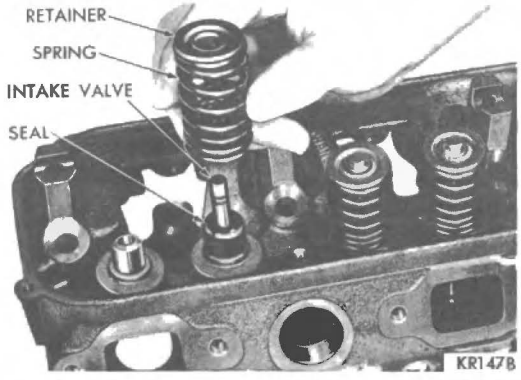


Fig. 10 Installing Valve and Cup Seals

NOTE: If the valve and /or seats are reground, measure the installed height of springs. Make sure measurement is taken from the bottom of the spring seat in cylinder head to the bottom surface of spring retainer. (If spacers are installed, measure from the top of spacer). If height is greater than 1 11/16 inches, install a 1/16 inch spacer in head counterbore to bring spring height back to normal.

5. TESTING THE VALVE TIMING

(1) Turn the crankshaft until the No.6 exhaust valve is closing and the No. 6 intake valve is opening.

(2) Turn the No. 1 intake valve adjusting screw in one complete turn. (Second valve in the left bank).

(3) Install a dial indicator on No. 1 intake valve so that the plunger contacts the valve spring retainer as nearly perpendicular as possible. Zero the indicator.

(4) Turn the crankshaft clockwise (normal running direction) until intake valve has lifted .028 inches.

CAUTION: Do not turn crankshaft any further clockwise as the valve spring might bottom and result in serious damage.

The timing on the crankshaft pulley, should read from 10 degrees BTDC to 2 degrees ATDC. If the reading is not within specified limits. (1) Check sprocket index marks, (2) Inspect the timing chain for wear, (3) Check the accuracy of the "O" mark on the timing indicator. Turn the crankshaft counter-clockwise until the valve is closed and remove the indicator and readjust lash.

6. TIMING SPROCKETS AND CHAIN

Removal

(1) Drain the cooling system and remove the radiator and water pump assembly.

(2) Remove the bolt holding the vibration damper on the crankshaft.

(3) Remove two of the pulley bolts, install Tool C-3688 and pull the damper assembly off the end of crankshaft, as shown in Figure 11.

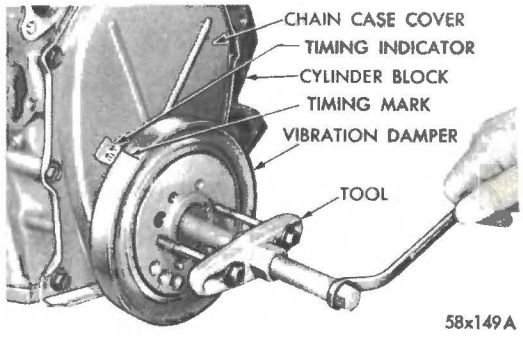


Fig. 11 Removing Vibration Damper Assembly Using Tool C-3688

(4) Remove the fuel line and fuel pump.

(5) Remove the chain case cover and gasket, using extreme caution to avoid damaging the oil pan gasket. It is normal to find particles of neoprene collected between the crankshaft seal retainer and the crankshaft oil slinger.

(6) Slide the crankshaft oil slinger off the end of the crankshaft.

(7) Remove the camshaft sprocket attaching bolt.

(8) Remove the timing chain with the crankshaft and camshaft sprockets.

Installing Timing Chain

When installing the timing chain, use Tool CA-3509 to prevent the camshaft from contacting the welch plug in the rear of the engine block. Remove the distributor and the oil pump-distributor drive gear. Locate tool against rear side of cam gear and attach the tool with distributor retainer plate bolt (Fig. 12). The tool should remain installed until the camshaft and crankshaft sprockets and timing chain have been installed.

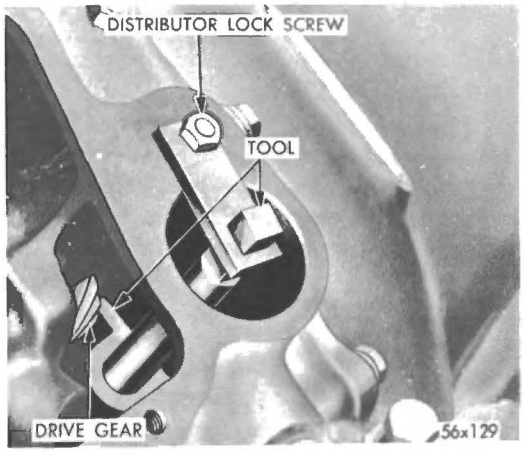


Fig. 12 Camshaft Holding Tool CA-3509

(1) Place both the camshaft sprocket and crankshaft sprocket on the bench with the timing marks in the exact imaginary centre line through both camshaft and crankshaft bores.

(2) Place the timing chain around both sprockets.

(3) Turn the crankshaft and camshaft to line up with the keyway location in crankshaft sprocket and the dowel holes in the camshaft sprocket.

(4) Lift the sprockets and chain (keep sprockets tight against the chain in position as described).

(5) Slide both sprockets evenly over their respective shafts.

(6) Use a straightedge to check the alignment of the timing marks. (Fig. 13).

(7) Install the washer and camshaft sprocket bolt and tighten to 35 lbs/ft. torque.

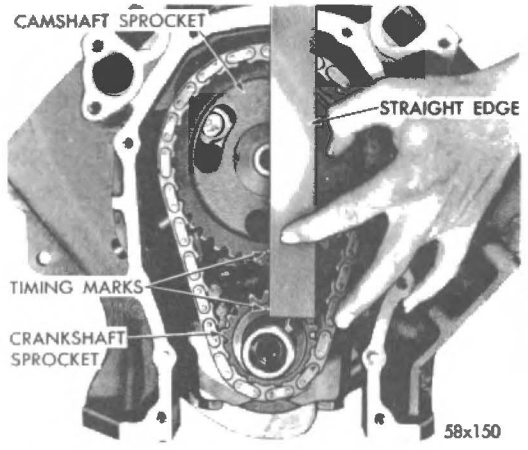


Fig. 13 Inspecting Alignment of Timing Marks Using a Straightedge (Typical)

Testing Timing Chain for Stretch

(1) Place a scale next to the timing chain so that any movement of the chain may be measured.

(2) Place a torque wrench and socket over the camshaft sprocket attaching bolt and apply torque in the direction of crankshaft rotation to take up the slack; 30 lbs/ft (with cylinder head installed) or 15 lbs/ft (cylinder heads removed).

(3) Holding a scale with dimensional reading even with the edge of a chain link, apply torque in the reverse direction 30 lbs/

ft.(with cylinder heads installed) or 15 lbs/ ft. (cylinder heads removed), and note the amount of chain movement, as shown in Figure 14.

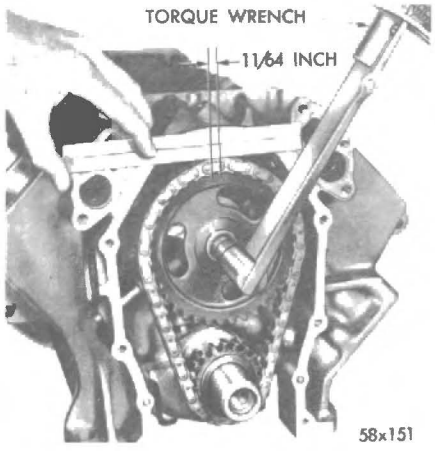


Fig. 14 Measuring Chain Stretch (Typical)

(4) Install a new timing chain, if its movement exceeds 3/16 inch.

NOTE: With torque applied to the camshaft sprocket bolt, the crankshaft should not be permitted to move. It may be necessary to block the crankshaft to prevent rotation.

(5) If the chain is satisfactory, slide the crankshaft oil slinger over the shaft and up against the sprocket (flange away from sprocket).

7. TIMING CHAIN CASE COVER OIL SEAL REPLACEMENT

Removal

(1) Position the puller screw of Tool CA-3506 through case cover, the inside of case cover up. Position the puller blocks directly opposite each other, and force the angular lip between the neoprene and flange of the seal retainer.

(2) Place the tool washer and nut on puller screw. Tighten the nut as tight as possible by hand, forcing the blocks into the gap to a point of distorting the seal retainer lip (Fig. 15). This is important (puller is only positioned at this point).

(3) Place the sleeve over the retainer and place removing and installing plate into sleeve.

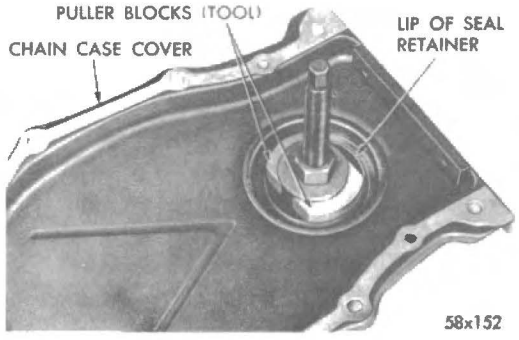


Fig. 15 Puller Blocks expanded to Puller Position (Tool CA-3506)

(4) Place the flat washer and nut on puller screw. Hold the centre screw and tighten the lock nut to remove the seal. (Fig. 16).

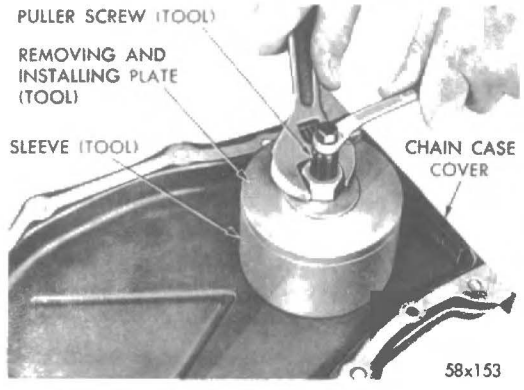


Fig. 16 Removing Oil Seal Tool CA-3506

Installation

(1) Insert the puller screw through the removing and installing plate so that the thin shoulder will be facing up.

(2) Insert the puller screw with plate through the seal opening (inside of chain case cover facing up).

(3) Place the seal in the cover opening, with neoprene down. Place the seal installing plate into the new seal, with protective recess toward lip of seal retainer.(Fig. 17).

(4) Install the flat washer and nut on puller screw, hold screw and tighten the nut (Fig. 18).

NOTE: Lip of the neoprene seal must be toward the source of oil.

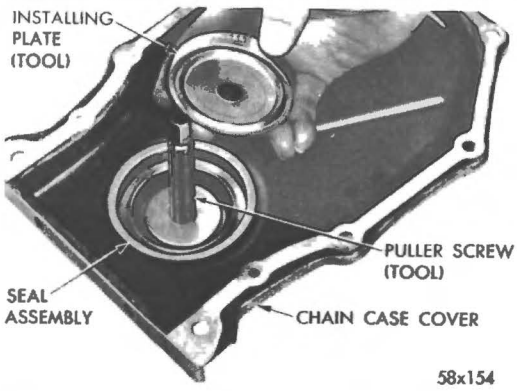


Fig. 17 Positioning Installer Plate on New Seal Tool CA-3506

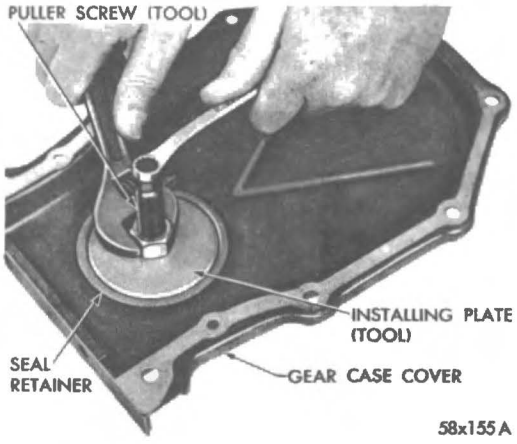


Fig. 18 Installing New Seal Tool CA-3506

(5) The seal is properly installed when neoprene is tight against the face of the cover. Try to insert a .0015 feeler gauge between the neoprene and the cover (Fig. 19). If this seal is installed properly, the feeler gauge cannot be inserted. It is normal to find particles of neoprene collected between the seal retainer and crankshaft oil slinger after the seal has been in operation.

Fig. 19 Measuring Seal for Proper Seating

Installing Chain Case Cover

(1) Be sure the mating surfaces of the chain case cover and cylinder block are clean and free from burrs.

(2) Using a new gasket slide the chain case cover over the locating dowels and tighten bolts to 15 lbs/ft. torque. Use extreme caution to avoid damaging the oil pan gasket.

(3) Install the fuel pump lines and fuel pump.

(4) Install the water pump and housing assembly using new gaskets, tighten bolts to 30 lbs/ft. torque.

Installing Vibration Damper

(1) Install the hub on the crankshaft.

(2) Place the installing tool, part of puller set Tool C-3688 in position and press the damper hub on the crankshaft (Fig. 20).

(3) Slide the pulley over the shaft and attach with bolts and lockwashers.

(4) Tighten the bolts of 15 lbs / ft. torque.

(5) Install damper hub retainer washer and bolt. Tighten to 135 lbs/ft. torque.

(6) Install radiator, fan belt, hoses and close the drains.

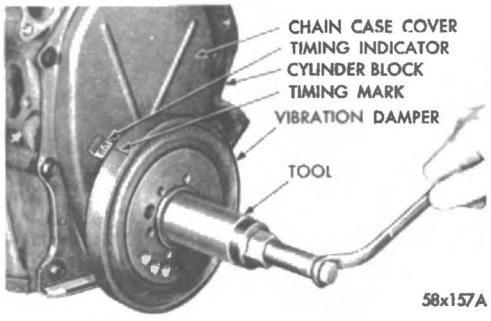


Fig. 20 Installing Vibration Damper Assembly Tool C-3688

(7) Fill the cooling system.

8. CAMSHAFT

Removal

The camshaft thrust is forward, and a thrust plate is used to control the .002 to .006 inch end play.

(1) With the tappets and timing sprockets removed, remove the distributor and lift out the oil pump and the distributor drive shaft.

(2) Install a long bolt into the front of the camshaft to facilitate the removal of the camshaft; remove the camshaft being careful not to damage the cam bearings with the cam lobes.

Installation

(1) Lubricate the camshaft lobes and camshaft bearing journals and insert the camshaft to within $\frac{1}{2}$ inch of its final position in the cylinder block.

(2) Install Tool CA-3509 as described in paragraph "Timing Chain and Sprocket".

(3) Push the camshaft into the final position.

(4) Keep the tool in place until the sprockets and the chain have been installed. Complete installation as described in Paragraph "Timing Chain and Sprockets".

NOTE: Whenever an engine has been rebuilt and a new camshaft and/or new tappets have been installed, the sump should be filled to correct level with a premium grade oil of recommended viscosity.

Whenever the camshaft is replaced, all of tappet faces must be inspected for crown with a straightedge. If any negative (crown dish) is observed, the tappet must be replaced.

9. CAMSHAFT BEARINGS (ENGINE REMOVED FROM VEHICLE)

Removal

(1) With the engine completely disassembled, drive out the rear cam bearing welch plug.

(2) Install the proper size adaptors and horse shoe washers (part of Tool C-3132A) at the back of each bearing shell to be removed and drive out the bearing shells.

Installation

(1) Install the new camshaft bearings with Tool C-3132A by sliding the new camshaft bearing shell over the proper adaptor.

(2) Position the bearing in the tool. Install the horse shoe lock and by reversing the removal procedure, carefully drive bearing shell into place, as shown in Figure 21.

(3) Install the remaining shells in like manner.

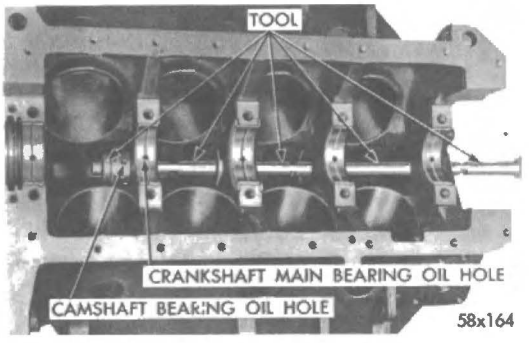


Fig. 21 Removing Camshaft Bearing Using Tool C-3132A

NOTE: Install the No. 1 camshaft bearing 1/32" inward from the front face of the cylinder block.

The oil holes in the camshaft bearings and cylinder block must be in exact alignment to ensure proper lubrication. (Fig. 21).

Camshaft bearing index can be inspected after installation by inserting a pencil

flashlight in the bearing shell. The camshaft bearing oil hole should be perfectly aligned with the drilled oil passage from the main bearing. Also the Number 4 bearing must index with the two oil passages to the cylinder heads. If the camshaft bearing shell oil holes are not in exact alignment, remove and reinstall them correctly. Apply suitable sealer to the plug and use Tool C-897 to install a new core hole plug at the rear of camshaft. Be sure this plug does not leak.

10. DISTRIBUTOR DRIVE SHAFT BUSHING

Removal

(1) Insert Tool CA-3052 into the old bushing and thread down until a tight fit is obtained. (Fig. 22).

(2) Hold the puller screw and tighten puller nut until the bushing is removed.

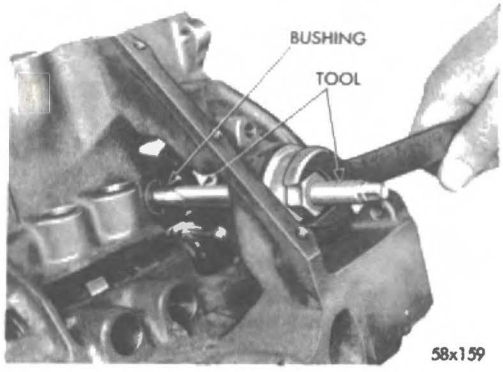


Fig. 22 Removing Distributor Drive Shaft bushing Using Tool CA-3052

Installation

(1) Slide a new bushing over the burnishing end of Tool CA-3053 and insert the tool bushing into the core, as shown in Figure 23.

(2) Drive the bushing and tool into position, using a soft hammer.

(3) As the burnisher is pulled through the bushing by tightening the puller nut, the bushing is expanded tight in the block and burnished to correct size, as shown in Figure 24. DO NOT REAM THIS BUSHING.

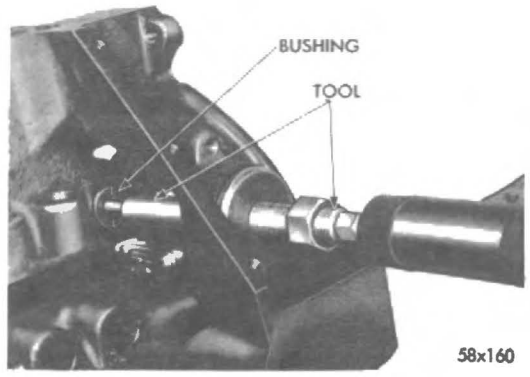


Fig. 23 Installing Distributor Drive Shaft Bushing Using Tool CA-3053

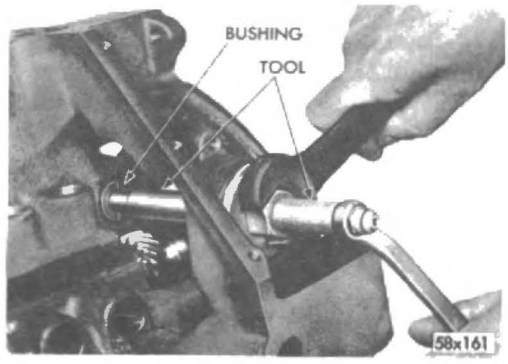


Fig. 24 Burnishing Distributor Drive Shaft Bushing Using Tool CA-3053

Distributor Timing

Before installing the distributor and oil pump drive shaft, time the engine as follows:

(1) Rotate the crankshaft until the No.1 cylinder is at top dead centre on the firing stroke.

(2) When in this position, the straight line on the vibration damper should be under ("O") on the timing indicator.

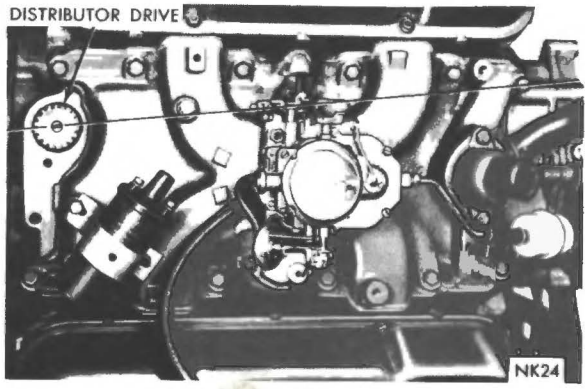


Fig. 25 Position of Distributor Drive Shaft

(3) Coat the shaft and drive gear with engine oil. Install the distributor drive gear so when the gear spirals into place on the camshaft, the slot in the top of the distributor drive gear should be pointing to the first intake manifold bolt on the left side of engine. (Fig. 25).

Installation of Distributor

(1) Hold the distributor over the mounting pad on the cylinder block with the vacuum chamber pointing to number 8 spark plug.

(2) Turn the rotor until it points to the approximate location of the No. 1 tower terminal in the distributor cap.

(3) Place the distributor gasket in position.

(4) Lower the distributor and engage the shaft in the slot of the distributor drive shaft gear.

(5) Turn the distributor counter-clockwise until the breaker contacts are just separating, and install hold down clamp.

II. CYLINDER BLOCK

Cleaning and Inspection

(1) With the engine in repair stand C-3167 and the cylinder heads, oil pan and timing chain removed, clean the cylinder block thoroughly. Inspect all core plugs for evidence of leaking.

(2) If new core plugs are installed coat the edges of the plug and core hole with a suitable sealer and drive the plugs in place with a suitable driver.

(3) Examine the block for cracks or fractures.

(4) Remove the top ridge of the cylinder bores with a reliable ridge remover before removing the pistons from the cylinder block. Be sure to keep the tops of the pistons covered during this operation.

NOTE: Pistons and connecting rods must be removed from the top of the cylinder block. When removing the piston and connecting rod assemblies from the engine, rotate crankshaft so each connecting rod is centred in the cylinder bore.

(5) Remove the oil strainer, tube and oil pump.

(6) Mark all bearing caps as necessary for proper location.

(7) Remove the connecting rod cap.

(8) Install Tool CA-3221 on one connecting rod bolt and protector over the other bolt and push each piston and rod assembly out of the cylinder bore.

(9) After removal, install the bearing cap on the mating rod.

Cylinder Bore Inspection

The cylinder walls should be measured for out-of-round and taper with Tool C-119. If the cylinder bores show more than .005" out-of-round, or taper of more than .010" or if the cylinder walls are badly scuffed or scored, the cylinder block should be rebored and honed, and new pistons and rings fitted. Whatever type of boring equipment is used, boring and honing operation should be closely co-ordinated with the fitting of pistons and rings in order that specified clearances may be maintained.

Honing Cylinder Bores

Before honing, stuff plenty of clean rags under the bores, over the crankshaft to keep the abrasive materials from entering the crankcase area.

(1) Use carefully, the cylinder bore resizing hone Tool C-823, equipped with 220 grit stones, is the best tool for this job. In addition to deglazing, it will reduce taper and out-of-round as well as removing light scuffing, scoring or scratches. Usually a few strokes will clean up a bore and maintain the required limits.

(2) Deglazing of the cylinder walls may be done using a cylinder surfacing hone, Tool C-3501, equipped with 280 grit stones (Tool C-3501 - 3810). If the cylinder bore is straight and round, 20-60 strokes depending on the bore condition will be sufficient to provide a satisfactory surface. Inspect cylinder walls after each 20 strokes. Use a light honing oil. Do not use engine or transmission oil, mineral spirits or kerosene.

(3) Honing should be done by moving the hone up and down fast enough to get a cross-hatch pattern. When hone marks intersect at 60°, the cross hatch angle is most satisfactory for proper seating of rings (See Fig. 26).

Fig. 26 Cross-Hatch Pattern

(4) After honing, it is necessary that the block be cleaned again to remove all traces of abrasives.

CAUTION: Be sure all abrasives are removed from engine parts after honing. It is recommended that a solution of soap and water be used with a brush and the parts then thoroughly dried. The bore can be considered clean when it can be wiped clean with a white cloth and the cloth remains clean. Oil bores after cleaning to prevent rusting.

12. PISTONS AND RINGS

The pistons are cam ground so that the diameter at the pin boss is less than its diameter across the thrust face. This allows for expansion under normal operating conditions. Under operating temperatures, expansion forces the pin bosses away from each other, thus, causing the piston to assume a more nearly round shape. It is important that pistons be checked for taper and elliptical shape before they are fitted into the cylinder bore (See Fig. 27).

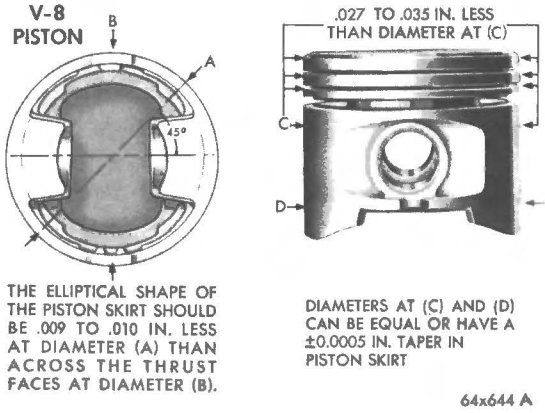


Fig. 27 Piston Measurement

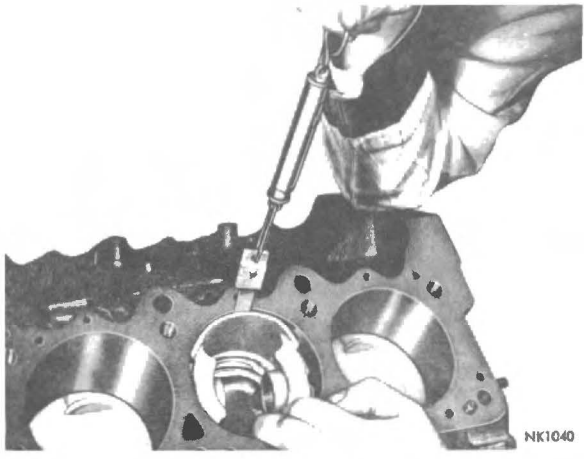


Fig. 28 Fitting Piston in Cylinder Bore

Finished Pistons

All pistons are machined to the same weight in grams, regardless of oversize to maintain piston balance. For cylinder bores which have been honed or rebored, pistons are available in standard and the following oversizes: .005, .020, .040 inch.

Fitting Pistons

The cylinder walls and pistons must be clean and dry.

Piston fitting should be done at normal room temperature, 70°. Use a spring scale and a strip of ½ inch wide feeler stock .0015 inch thickness. The feeler stock should be long enough to extend into the cylinder bore to the full length of the piston travel.

(1) Coat the cylinder bore lightly with SAE 10W engine oil. Insert the piston in the bore upside down with the feeler stock between the thrust face of the piston and the cylinder wall.

(2) Hold the piston and draw the feeler stock straight out, with the spring scale Tool C-690 as shown in Fig. 28. The amount of pull required should be from 5 to 10 pounds.

Piston Rings

(1) Measure the piston ring gap about 2 inches from the bottom of the cylinder bore in which it is to be used. (An inverted piston can be used to push the rings down into position. This will ensure the rings being exactly square with the cylinder wall before measuring.)

(2) Insert the feeler stock in the gap. The ring gap should be from .010 inch to .020 inch for the compression rings and .015 inch to .062 inch for the oil ring steel rails in standard size bores (for new service rings). Maximum gap in .005 inch O/S bores should be .060 inch for compression rings and .070 for oil ring steel rails.

(3) Measure the side clearance between piston ring and ring land. The clearance should be .0015 to .003 inch for the top compression ring and the intermediate ring, and .001 to .009 for the oil control ring. (For new service rings.) (Fig. 29).

(4) Install the oil ring in the lower ring groove using the instructions in the service ring package.

(5) Install the compression rings in the middle and top grooves with side marked "TOP" up; use ring installer Tool C-263.

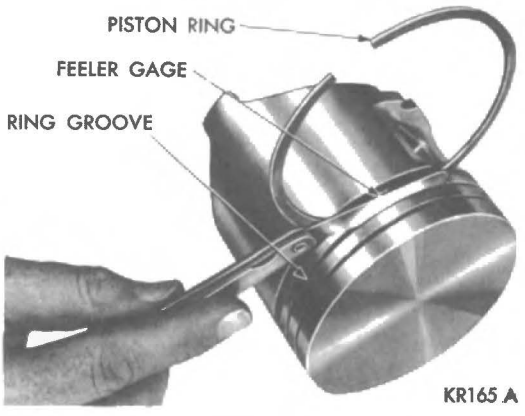


Fig. 29 Measuring Piston Ring Clearance

13. PISTON PIN

Removal

(1) Mark all pistons and connecting rods as necessary for proper location.

(2) Remove piston pin lock rings and press out piston pins.

Fitting Piston Pins

(1) The piston pin fit in the connecting rod and piston should be a tight thumb push fit at normal room temperature, 70°F.

(2) If there is excessive clearance between the piston pin and piston, ream piston and connecting rod to next oversize. Piston pins are available in standard, .003, .008 inch oversize.

(3) If there is excessive clearance between the piston pin and connecting rod, replace the connecting rod bushing and fit bushing to the piston pin.

(4) New pistons are supplied with fitted pins.

Installation

(1) Assemble pistons and rods for the left hand cylinder bank (1-3-5-7) with piston boss marked "Front" and indent on piston head on the same side as the large chamfer on large end of connecting rod. Assemble pistons and rods to be used in the right cylinder bank (2-4-6-8) with "Front" and indent opposite the large chamfer in the connecting rod.

14. CONNECTING ROD BEARINGS

Installation

NOTE: Fit all rods on one bank until completed. Do not alternate from one bank to another, because when the rods are assembled to pistons correctly, they are not interchangeable from one bank to another.

Connecting rod bearings caps have a small "V" groove across the parting face. When installing a lower bearing, the "V" groove of the bearing must be placed on the "V" groove side of the cap. This provides lubrication of the cylinder wall in the opposite bank. Also, the tangs in the steel back must be placed in the grooves in the rods and caps. The connecting rod side play should be .006 to .014 inch (two rods).

The limits of taper or out-of-round on any crankshaft journals should be held to .001 inch. Bearings are available in .001, .002, .003, .010 and .012 inch undersize. Install the bearings in pairs.

15. MEASURING CONNECTING ROD BEARING CLEARANCE

Shim Stock Method

(1) Place an oiled .001 inch feeler stock ($\frac{1}{2}$ inch wide and 3/4 inch long) between bearing and connecting rod journal.

(2) Install bearing cap and tighten to 45 lbs/ft. torque.

(3) Turn the connecting rod $\frac{1}{4}$ turn in each direction. A slight drag should be felt which indicates clearance is satisfactory. The correct clearance is from .0005 to .0015 inch.

(4) Side play should be .006" to .014" (Two rods).

16 PISTON AND CONNECTING ROD ASSEMBLY

Installation

(1) Before installing the pistons, rods and rod assemblies in the bore, be sure that compression ring gaps are staggered so that neither are in line with the oil ring rail gaps.

(2) The oil ring expander ends should be positioned toward the outside of the "V" of the engine. The oil ring rail gaps should be positioned opposite each other and above the piston pin holes.

(3) Immerse the piston head and rings in clean engine oil, slide the ring compressor, Tool C-385, over the piston and tighten with the special wrench (part of Tool C-385).

(4) Be sure the position of the rings does not change during this operation. Screw the connecting rod bolt protector (part of Tool CA-3221) on one rod bolt, and insert the rod and piston into cylinder bore.

NOTE: Rotate the crankshaft so that the connecting rod journal is on centre of the cylinder bore.

(5) Attach the puller part of Tool CA-3221 on the other bolt, and guide the rod over the crankshaft journal.

(6) Tap the piston down in the cylinder bore, using the handle of a hammer. At the same time, guide the connecting rod into position on the crankshaft journal.

(7) The notch or groove on the top of the piston must be pointing toward the front

of the engine and the larger chamfer of the connecting rod bore must be installed toward the crankshaft journal fillet.

(8) Install the rod caps and tighten nuts to 45 lbs/ft. torque.

17. CRANKSHAFT MAIN JOURNALS

The crankshaft journals should be inspected for excessive wear, taper and scoring. Journal grinding should not exceed .012 inch under the standard journal diameter. DO NOT grind the thrust faces of No. 3 main bearing. DO NOT nick the crankpin or main bearing fillets. After regrinding, remove the rough edges from the crankshaft oil holes and clean out all the oil passages.

18. CRANKSHAFT MAIN BEARINGS

The upper main bearings are not interchangeable with the lower main bearings (Fig. 30). Bearing numbers 1, 2 and 4 are interchangeable as complete bearings. The No. 1 upper main bearing is not interchangeable and is chamfered on the tab side for timing chain oiling and can be identified by a red marking on the edge of the bearing.

On all engines, number 3 bearing halves are flanged to carry the thrust load and are not interchangeable with the other four bearings. Bearings that are not badly worn or pitted must be reinstalled in the same position.

The bearing caps are not interchangeable and should be marked at removal to ensure the correct assembly. Bearing shells are available in standard and the following undersizes: .001, .002, .003, .010 and .012 inch. Never install an undersize bearing shell that will reduce the clearance below specifications.

Removal

(1) Remove the oil pan and mark the bearing caps before removal.

(2) Remove the bearing caps one at a time. Remove the upper half of the bearing by inserting Tool C-3059 (Fig. 31) into the oil hole of the crankshaft.

(3) Slowly rotate the crankshaft clockwise, forcing out the upper half of bearing shell.

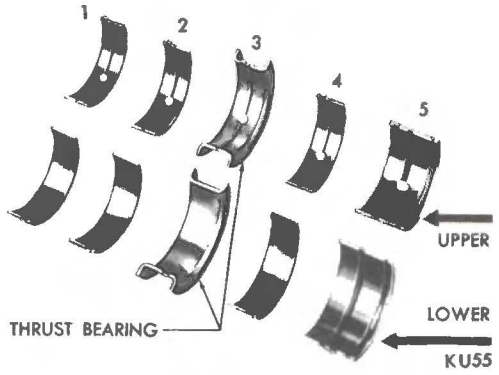


Fig. 30 Main Bearing Identification

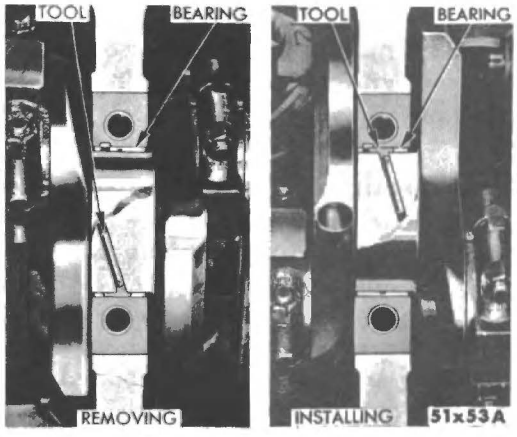


Fig. 31 Removing or Installing Main Bearing

19. MEASURING MAIN BEARING CLEARANCE

(Shim Stock Method)

(1) Smooth the edges of a $\frac{1}{2}$ x 3/4 inch piece of soft copper or brass shim stock .001 inch thickness.

(2) Lubricate the main bearing journals and position the shim stock across the centre main journal.

(3) Install the bearing in the centre main bearing cap, bearing tang in groove

in cap, lubricate bearing and seat cap or block. Tighten bolts to 85 lbs/ft. torque.

(4) If a slight drag is felt as the crankshaft is turned (move no more than $\frac{1}{4}$ turn in either direction), the clearance is .001 inch or less and is considered satisfactory.

If however, no drag is felt, the bearing is too large or the crankshaft cannot be rotated, the bearing is too small and should be replaced with the correct size.

(5) Measure crankshaft end play to .002 - .007 inch. If end play is less than .002" or more than .007", install a new Number 3 main bearing.

(6) Fit the remaining bearings in same manner.

Only one main bearing should be selectively fitted while all other main bearing caps are properly torqued.

It is permissable to use one .001 inch undersize bearing shell with one standard bearing shell or one .002 inch bearing shell with one .001 inch undersize shell. Always use the smaller diameter bearing half as the upper. Never use a new bearing with a used bearing and never use an upper bearing half more than .001 inch smaller than the lower bearing half.

Installation of the Upper Main Bearing

NOTE: When installing a new upper bearing shell, slightly chamfer the sharp edges from the plain side.

(1) Start bearing in place, and insert Tool C-3059 into the oil hole of the crankshaft. (Fig. 31).

(2) Slowly rotate the crankshaft counter-clockwise sliding the bearing into position.

(3) After all bearings have been fitted, tighten all caps to 85 lbs/ft. torque. The crankshaft end play should be .002"-.007".

20. REPLACEMENT OF THE REAR MAIN BEARING OIL SEALS- (CRANKSHAFT REMOVED)

Upper Seal

(1) Scrape off old dry sealer from cylinder block.

(2) Install a new rear bearing oil seal so that both ends protrude.

(3) Use Tool C-3511 (with bridge removed) tap the seal down into position until the tool is seated in the bearing bore.

(4) Hold the tool in this position and cut off the portion of the seal that extends above the block on both sides.

(5) Coat the joint face of the ends of the seal with sealer cement Part No. 2299314.

CAUTION: The sealer should not be put on the seal where it contacts the crankshaft or near the bearing shell.

Lower Seal.

(1) Scrape off old sealer from bearing cap.

(2) Install a new rear bearing oil seal in the cap with Tool C-3511.

(3) Hold the tool in this position and cut off the ends of seal flush with cap.

(4) Coat the joint face of the ends of the seal and $\frac{1}{4}$" to each side of the rubber side gaskets with sealer cement Part No. 2299314.

CAUTION: The sealer should not be put on the seal where it contacts the crankshaft or near the bearing shell.

(5) Install the bearing shell and tighten bearing cap bolts to 85 lbs/ft.

NOTE: Always oil seals before installing and tightening cap.

ENGINE OILING SYSTEM

1. REMOVAL

With the oil pan removed, remove the oil pump from the rear main bearing cap.

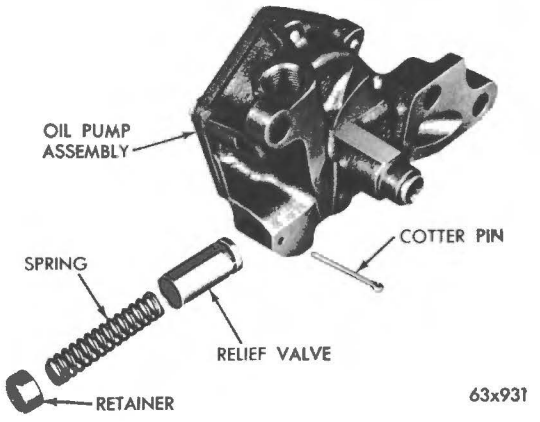


Fig. 1 Oil Pump Assembly

2. DISASSEMBLY

(1) Remove the cover screws and remove the cover.

(2) Remove the pump rotor and shaft and lift out the outer pump rotor.

(3) Remove the oil pressure relief valve plug carefully as it is under spring pressure. Remove the spring and the valve.

(4) Clean all parts thoroughly.

3. INSPECTION AND REPAIR

(1) Lay a straightedge across the oil pump cover surface. If a .0015 inch feeler gauge can be inserted between the cover and the straightedge, the cover should be replaced.

(2) The outer rotor length should not be less than .825 inch and the outer diameter less than 2.469 inch.

(3) If the inner rotor thickness measures less than .825 inch a new rotor should be installed.

(4) Place the outer rotor in pump body. Press the rotor to one side with the fingers and measure the clearance between the rotor and pump body. If the measurement is more than .012 inch, install a new oil pump body. (This test is not necessary if a new pump body is being used).

(5) Place the inner rotor in the outer rotor. Measure the clearance between the inner rotor and outer rotor. If measurement is more than .010 inch, install new pump rotors.

(6) Place a straightedge across the pump body (between bolt holes). If feeler gauge of more than .004 inch can be inserted between the rotor and a straightedge, install a new pump body and/or rotors.

(7) Inspect the oil pump relief valve plunger for scoring and for free operation in its bore. Small scores may be removed with 400 grit wet or dry paper providing extreme care is used not to round off the sharp edge portion of the valve.

(8) The relief valve has a free length of 2-1/32 to 2-3/64 inch.

(9) If the oil pressure is low, inspect for worn bearings or look for other causes of possible loss of oil pressure.

4. ASSEMBLY AND INSTALLATION

(1) Assemble the oil pump, using new parts as required.

(2) Install new oil and seal rings between the cover and body. Tighten cover bolts to 10 lbs/ft. torque.

(3) Install the oil pump and tighten attaching bolts to 35 lbs/ft. torque.

GROUP 11

EXHAUST SYSTEM

SERVICE BULLETIN REFERENCE

Date	Number	Subject	Changes

TORQUE SPECIFICATIONS

Exhaust pipe flange nuts	30 lbs./ft.
Intake to exhaust manifold bolts	15 lbs./ft.
Manifold to cylinder head nuts	10 lbs./ft.
Heat control counterweight clamp bolt... ...	50 lbs./ins.

SERVICE DIAGNOSIS
CONDITIONS — POSSIBLE CAUSES

1. EXCESSIVE EXHAUST NOISE OR VIBRATION

(1) Check for interference of exhaust pipe, muffler or tail pipe.

(2) Check hangers for looseness or damage and position hangers to ensure free movement of system.

(3) Check engine mounts for looseness, deterioration of rubber from oil or excessively hard rubber mounts.

(4) Check muffler for loose internal baffles.

(5) Loosen entire exhaust support system, road test to permit self alignment and re-tighten.

2. LEAKING EXHAUST GASES

(1) Mating faces of manifold to cylinder head should be checked and held to within .008" alignment.

(2) Check muffler and connections for leakage.

(3) Check tail pipe for restrictions.

(4) Check leaks at pipe joints and manifold connections.

(5) Check for cracked manifold.

(6) Remove manifold and install new gaskets if necessary, after carefully inspecting both cylinder head and manifold mating surfaces. Tighten manifold nuts evenly, working from centre to outer ends of manifold.

(7) Check for bent or pinched exhaust or tail pipes. Such conditions will retard the flow of exhaust gases. Install new parts as required.

(8) Tighten clamp at rear muffler connection.

3. ENGINE HARD TO WARM UP

(1) Check operation of heat control valve and make necessary repairs.

(2) Check for choke sticking.

4. MANIFOLD HEAT CONTROL VALVE RATTLE

(1) Check for broken thermostatic spring and make any necessary corrections.

(2) Check for weak or broken anti-rattle spring and make any necessary repairs or replacements.

(3) Check shaft for looseness in manifold.

SERVICE INFORMATION
PROCEDURES

1. GENERAL INFORMATION

The intake manifold (Fig. 1) consists of six long, curved tubes which supply fuel and air to each individual cylinder from a single-throat down-draught carburettor. The exhaust manifold, (Fig. 2) located on the same side of the cylinder head as the intake manifold, has large-radius curves, which permit exhaust gases to leave the cylinders with a minimum of back pressure

and power loss. A thermostatic heat control valve is incorporated to direct exhaust heat to a heat chamber beneath the carburettor to help vapourize the fuel for better warm-up performance. A well type automatic choke is standard equipment. Its sensing element is installed in a pocket in the exhaust manifold (Fig. 2) where it receives sufficient heat to make the choke open quickly for good warm-up fuel economy.

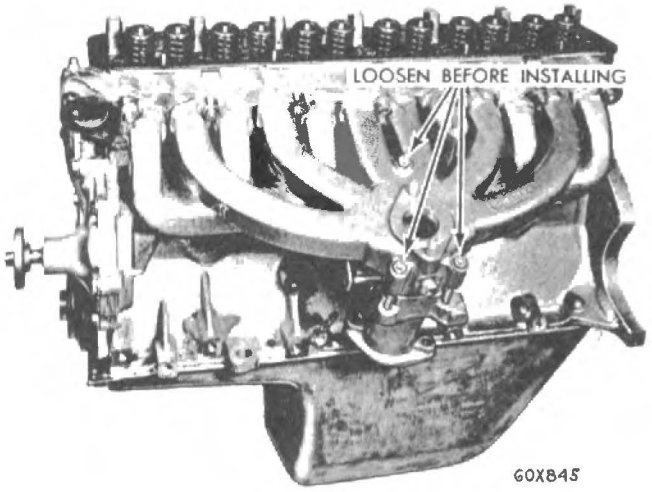


Fig. 1 - Intake manifold.

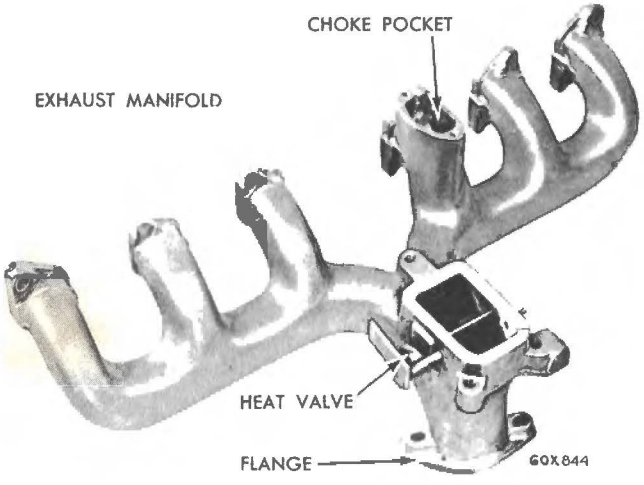


Fig. 2 - Exhaust manifold.

2. INTAKE AND EXHAUST MANIFOLD ASSEMBLY

Removal

(1) Remove air cleaner.

(2) Remove vacuum control tube at carburettor

(3) Disconnect fuel line, automatic choke, accelerator linkage and remove carburettor from engine.

(4) Disconnect the exhaust pipe at exhaust manifold flange.

(5) Remove nuts and conical washers holding intake and exhaust manifolds to the cylinder head.

(6) Remove the assembly from the cylinder head.

(7) Remove the three bolts holding intake manifold to exhaust manifold.

(8) Separate the manifolds and discard gasket.

(9) Clean the manifolds in solvent and dry with compressed air.

(10) Check the mating surfaces of the manifolds with a straightedge.

(11) Inspect manifolds for cracks or distortion.

Installation

(1) Install a new gasket between intake and exhaust manifolds.

(2) Install the three bolts holding the intake manifold to the exhaust manifold. Do not tighten bolts.

(3) Position the intake and exhaust manifold on the cylinder head using a new gasket.

(4) Install the brass washers and special nuts on the end manifold studs.

(5) Install the triangular washers on the front and rear end lower manifold studs, also on the upper and lower exhaust manifold studs on number 2 and 5 cylinders.

The six triangular washers should be positioned squarely on the machined surfaces of both the intake and exhaust manifold retaining pads. These washers must be installed with the conical side pointing away from the manifold. Install the washers and nuts only when engine and exhaust system is cold.

(6) Install other conical washers with cup side against the manifold.

(7) Tighten all manifold nuts to 10

lbs./ft. Do not overtighten these nuts as they can be easily stripped

(8) Tighten the three bolts holding the intake manifold to the exhaust manifold to 15 lbs./ft.

(9) Connect the exhaust pipe to the exhaust manifold flange and tighten nuts to 30 lbs./ft.

(10) Install carburettor and connect the fuel line, throttle linkage, automatic choke and vacuum control tube.

(11) Install the air cleaner.

3. EXHAUST MANIFOLD HEAT CONTROL VALVE (FIG. 3)

The purpose of the manifold heat control valve, is to direct hot exhaust gas to a heat chamber in the intake manifold and pre-heat the fuel-air mixture. Thus, the fuel is vapourized to a greater degree before entering into the combustion chamber, providing quicker warm up.

When engine is cold, the exhaust gases are deflected to the heat chamber of the intake manifold, and then circulate to the exhaust manifold. As the thermostatic coil heats, it loses tension and the valve closes the heat chamber, permitting exhaust gas to flow directly through the exhaust manifold. The heat control valve should be checked and lubricated with special oil at every lubrication or engine tune-up as follows:

(1) With the engine idling, accellerate momentarily to wide open throttle.

(2) The counterweight should respond by moving counter-clockwise approximately ½" and return to its normal position. If no movement is observed, the shaft is frozen or the coil spring is weak or broken. To free shaft or replace coil spring, proceed as follows:

(3) Remove counterweight, key and stop from end of shaft.

(4) Unhook coil spring from stop stud and remove from valve shaft slot.

(5) If valve shaft is frozen in manifold, apply manifold heat control valve solvent to both ends of shaft, and allow to stand for several minutes. Work the shaft back and forth until it turns freely.

(6) Position shaft in extreme clockwise position.

(7) Place new coil spring in position over shaft slot, with outer end (tongue) of coil spring in the upper left hand position. Press inner end of coil spring into slot of shaft.

(8) Wrap the outer end (tongue) of coil spring clockwise and engage under stop stud.

(9) Place counterweight on shaft (with the shield in upward position) and insert key in shaft slot.

(10) Centre counterweight on shaft and turn the valve counter-clockwise until bumper passes the stop stud.

(11) Press counterweight on shaft until seated. Tighten clamp bolt to 50 lbs./ins.

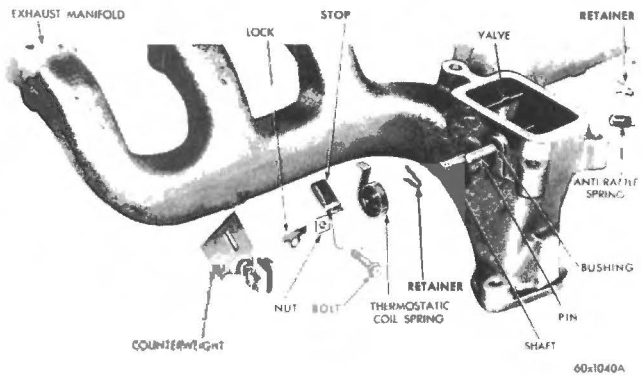


Fig. 3 - Exhaust manifold head control valve.

4. EXHAUST PIPE, MUFFLER AND TAIL PIPE

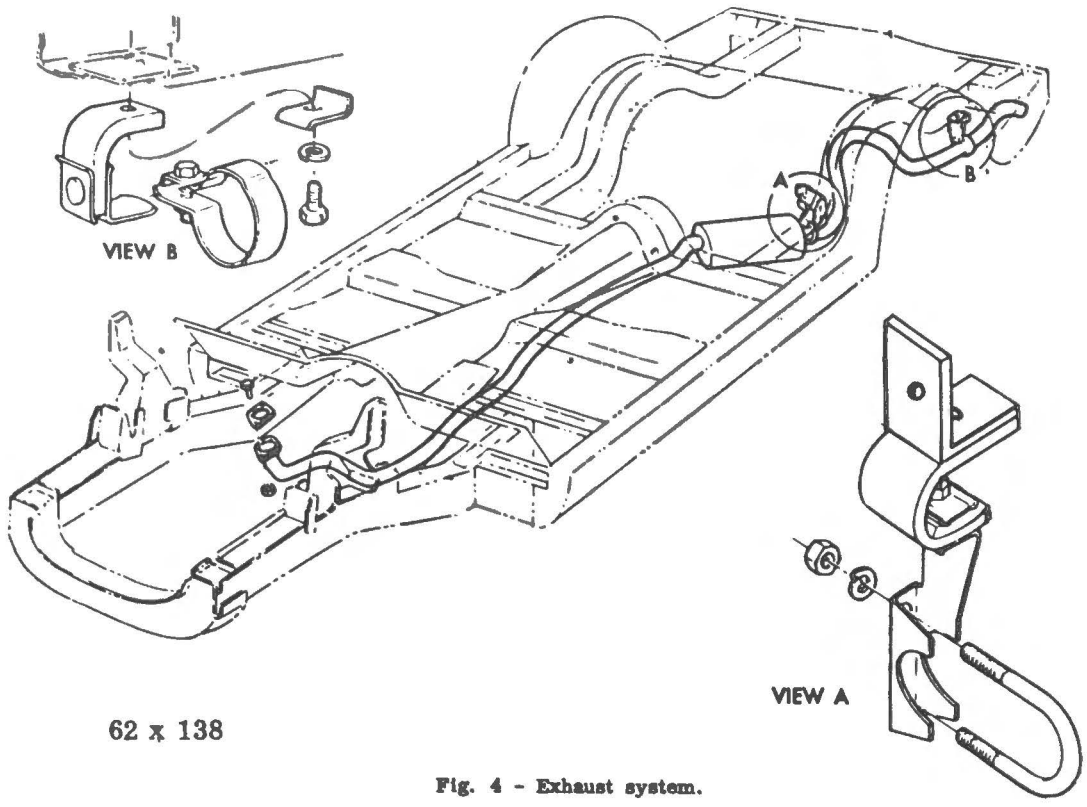
Removal

(1) Disconnect support clamps at rear end of tail pipe, and muffler slip joint.

(2) Disconnect exhaust pipe at exhaust manifold.

(3) Disconnect muffler from tail pipe and remove muffler and extension pipe assembly.

(4) Raise rear of car to relieve body weight from rear springs.



62 x 138

Fig. 4 - Exhaust system.

(5) Remove tail pipe.

Installation

(1) Reverse above procedure and assemble exhaust system loosely.

(2) Connect exhaust pipe at exhaust manifold and tighten nuts to 30 lbs./ft.

(3) Adjust hanger heights (if required).

(4) Tighten slip joint and rear support clamp to 10 lbs./ft.

GROUP 14

FUEL SYSTEM

PART 3 — FUEL PUMP

SERVICE BULLETIN REFERENCE

Date	Number	Subject	Changes

SERVICE DIAGNOSIS

CONDITIONS — POSSIBLE CAUSES

1. POOR IDLING

(1) Incorrect air idle adjustment.

(2) Idle air bleed carbonized or of incorrect size.

(3) Idle discharge hole plugged or gummed.

(4) Throttle body carbonized or worn throttle shaft.

(5) Air leak at mounting between carburettor and manifold.

(6) Damaged or worn idle mixture needle.

(7) Incorrect fuel or float level.

(8) Choke does not completely open.

(9) Carburettor icing.

(10) Distributor advance vacuum leak.

(11) Loose distributor base plate bearing.

(12) Corroded wire ends or distributor towers.

(13) Incorrect distributor point gap.

(14) Fouled spark plugs.

(15) Incorrect ignition timing.

(16) Incorrect spark plug gap.

(17) Overheated spark plugs.

(18) Incorrect valve timing.

(19) Compression not within limits.

(20) Intake manifold leak.

(21) Manifold heat control valve stuck.

(22) Internal coolant leak.

(23) Low grade fuel.

2. POOR PERFORMANCE — MIXTURE TOO LEAN

(1) Damaged main metering jet.

(2) Vacuum piston worn or stuck.

(3) Incorrect fuel or float level.

(4) Automatic choke not operating properly.

(5) Incorrect fuel pump pressure.

3. POOR PERFORMANCE — MIXTURE TOO RICH

(1) Restricted air cleaner.

(2) Excessive fuel pump pressure.

(3) High fuel or float level.

(4) Damaged needle and seat.

(5) Leaking float.

(6) Worn main metering jet.

(7) Sticking choke.

4. EXCESSIVE FUEL CONSUMPTION

(1) Overloading (pulling trailers etc.).

(2) Incorrect speedometer pinion.

(3) Brakes dragging.

(4) Driving at excessive speeds.

(5) Low tyre pressures.

(6) Short trip or heavy traffic driving.

(7) Driving in sand or mud.

(8) Driving in high winds.

(9) Unnecessary use of accellerator.

(10) Sticky choke.

(11) Incorrect ignition timing.

(12) Incorrect distributor advance.

(13) Incorrect valve timing.

(14) High fuel level in carburettor.

(15) Stuck manifold heat control valve.

(16) Detonation or pre-ignition.

(17) Low engine compression.

(18) Worn camshaft lobes.

(19) Sticking valves.

(20) Elevation and atmospheric conditions.

(21) Restricted muffler or tail pipe causing back pressure.

5. CARBURETTOR FLOODS OR LEAKS

(1) Cracked body.

(2) Defective gaskets.

(3) High float or fuel level.

(4) Worn needle valve and seat.

(5) Leaking float.

(6) Excessive fuel pump pressure.

NOTE: Presence of fuel dye around carburettor gaskets does not necessarily denote a leak or a flooding condition.

6. POOR ACCELERATION

(1) Broken economizer diaphragm stem spring (lean mixture at wide open throttle).

(2) Faulty accellerator pump discharge needle.

(3) Accellerator pump inlet check ball faulty.

(4) Incorrect fuel or float level.

(5) Worn accellerator pump and throttle linkage.

(6) Automatic choke not operating properly.

(7) Carburettor gummed up.

(8) Faulty coil.

(9) Loose distributor base plate bearing.

(10) Distributor not advancing properly.

(11) Incorrect ignition timing.

(12) Incorrect spark plug gap.

(13) Fouled spark plugs.

(14) Overheated spark plugs.

(15) Manifold heat control valve stuck.

(16) Low fuel pump pressure or vacuum.

(17) Compression not within specifications.

(18) Incorrect valve timing.

(19) Low grade of fuel.

(20) Detonation or pre-ignition.

PART I — HOLLEY CARBURETTOR

SPECIFICATIONS

CARBURETTOR

Type	Single Throat-Down Draught			
Model	Holley			
Manual Transmission	R-2535A R-2767A R-2887A			
Auto Transmission			R-2536A R-2768A R-2888A	
Bore	$1\frac{11}{16}$"		$1\frac{11}{16}$"	
Venturi	$1\frac{5}{16}$"		$1\frac{5}{16}$"	
Main Metering Jet				
Standard	57		56	
One step lean	56		55	
Two steps lean	55		54	
Adjustments				
Float setting	Use gauge CA-3903		CA-3903	
Economizer valve setting	4-6 (ins. of mercury)			
Choke unloader (See fast idle index adj.)				
Bowl vent valve	R-2535A	1/16"	R-2536A	1/16"
	R-2767A	1/16"	R-2768A	1/16"
	R-2887A	.080"-.125"	R-2888A	.080"-.125"
Idle mixture screw (turns open) approx.	1		1	
Idle speed (curb idle R. P. M.)	550		550	
Fast idle speed adjustment R. P. M.	R-2535A	1500	R-2536A	1500
	R-2767A	700	R-2768A	700
	R-2887A	700	R-2888A	700
Throttle pedal angle	R-2535A	112^{o}	R-2536A	112^{o}
	R-2767A	120^{o}	R-2768A	120^{o}
	R-2887A	120^{o}	R-2888A	120^{o}
Choke Model	R-2541A		R-2541A	
Control	Thermostatic coil spring			
Type	Well			
Setting	R-2535A - 2 notches rich		R-2536A- 2 notches rich	
	R-2767A - 2 notches rich		R-2768A- 2 notches rich	
	R-2887A - on "index"		R-2888A- on "index"	

SPECIAL TOOLS	
C-3748	Main jet - removing or installing
C-3886	Stand - Carburettor repair
CA-3903	Float Gauge
T-109-213	Bending Tool
C-3411	Pressure gauge

FUEL PUMP	
Make	Carter
Model	M2996S or M3674S
Type	Diaphragm
Number of valves	2
Driven by	Camshaft
Pump pressure.	$3\frac{1}{2}$ - 5 p.s.i.

FUEL TANK	
Location	Under trunk compartment
Capacity	14.3 gallons imp.

GENERAL INFORMATION

The fuel system consists of the fuel tank, fuel pump, fuel filter, carburettor, fuel lines and vacuum lines (Fig. 1).

The fuel tank assembly consists of the tank, filler neck and cap, air vent, and a fuel gauge sending unit.

In operation, the fuel pump draws fuel from the tank and forces it to the filter and carburettor. The carburettor meters the fuel into the air stream drawn into the engine, in quantities suitable for all engine speed and load conditions.

The fuel filter is a paper element, sealed, disposable type unit, located in the fuel line between the fuel pump and the carburettor. The filter should be replaced every 16,000 miles.

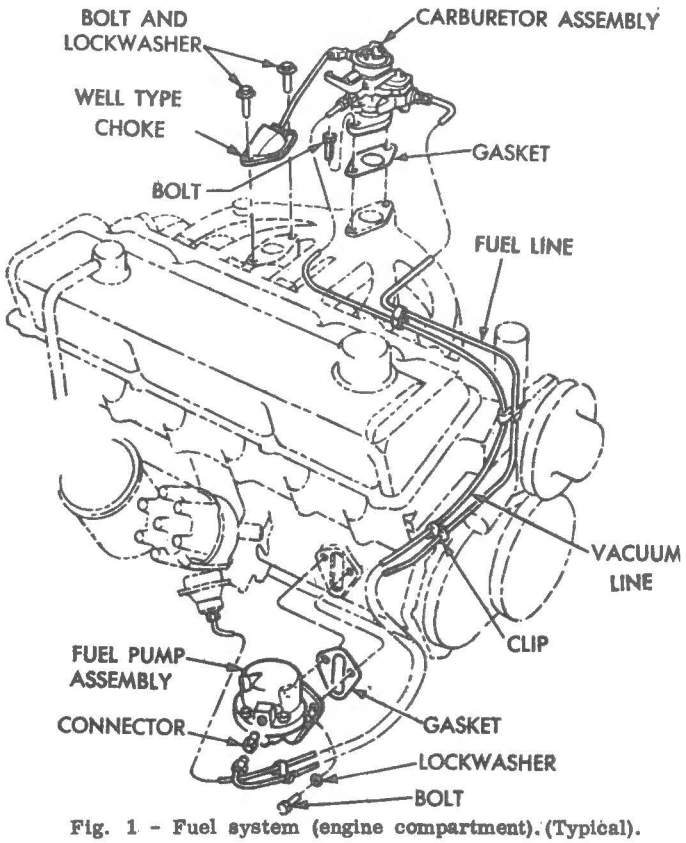


Fig. 1 - Fuel system (engine compartment). (Typical).

SERVICE INFORMATION — PROCEDURES

The Holley carburettor, model 1920 is a single bore, downdraught carburettor. Fuel from the bowl flows into the four basic fuel metering systems, which are: the idle system, the main metering system, the power enrichment system, and the accellerating pump system.

The choke valve located in the bore of the carburettor is connected to a well type automatic choke.

Additional fuel for accelleration is supplied by a diaphragm type mechanically operated pump. The pump is operated by a cam connected by linkage to the throttle shaft. An over-ride spring on the pump ensures a prolonged discharge of fuel for smoother operation.

A power valve mounted in the metering body, actuated by manifold vacuum, delivers the additional fuel necessary for full power and high speed operation.

The fuel-bowl is vented by an external vent valve located in the top of the bowl. The vent valve is connected by linkage to the throttle shaft, so that the valve is opened a prescribed distance when the vehicle is at idle or completely shut down.

Fuel Inlet and Float System

All fuel used by the four basic fuel metering systems enters the carburettor through the fuel inlet needle valve and seat assembly. The fuel under pressure from the engine's fuel pump, flows past the needle valve and into the float chamber. The float rises and falls with the fuel level in the float chamber, moving the fuel inlet needle valve correspondingly to control the amount of fuel admitted to the carburettor, as shown in Fig. 3. The fuel inlet system must constantly maintain this specified level of fuel because the basic fuel metering

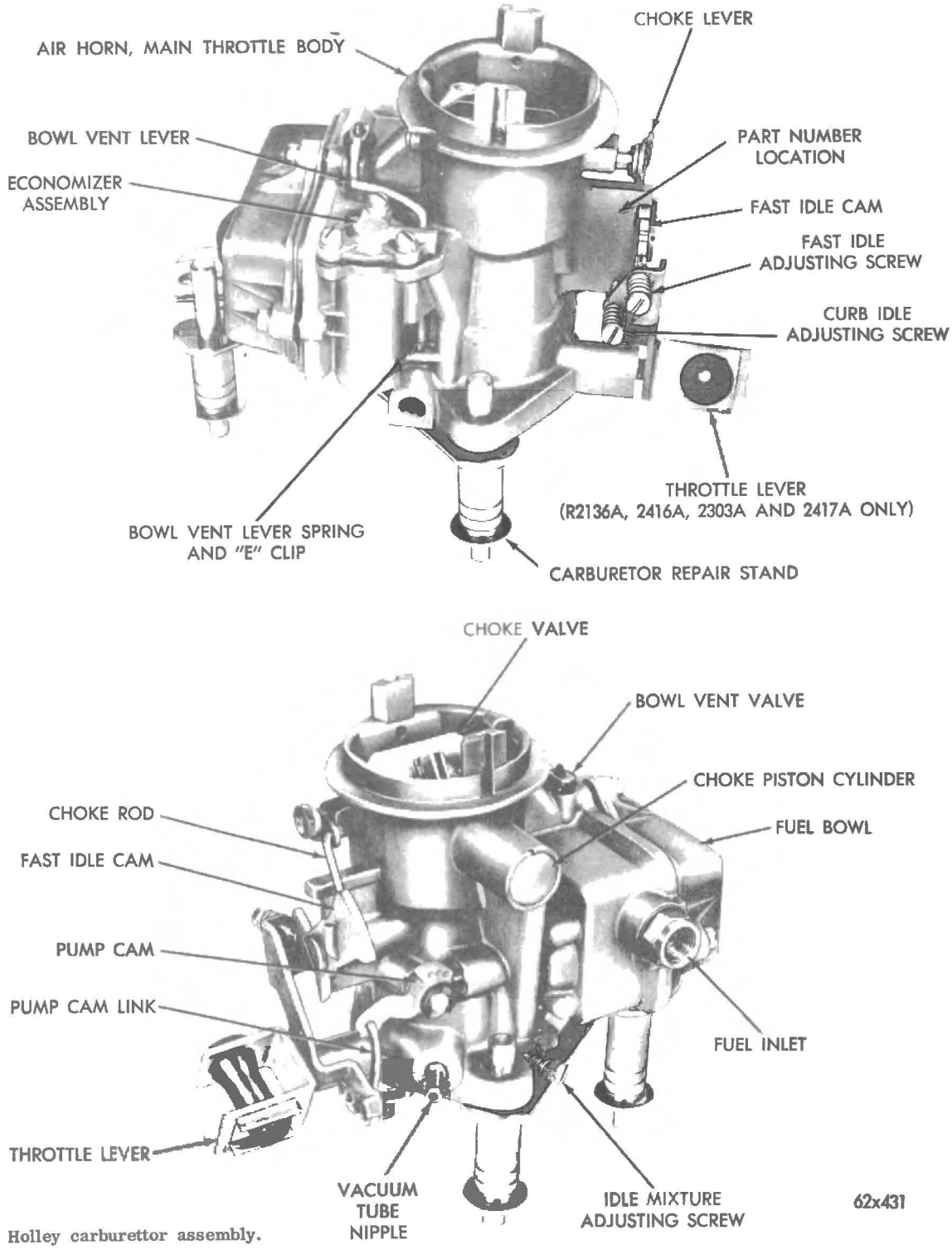


Fig. 2 - Holley carburettor assembly.

systems are calibrated to deliver the correct mixture only when the fuel is at this level.

The fuel bowl is vented internally by a vent passage which connects the fuel bowl with the air horn, and by an external vent valve in the top of the bowl, which opens when the throttle is returned to an idle position.

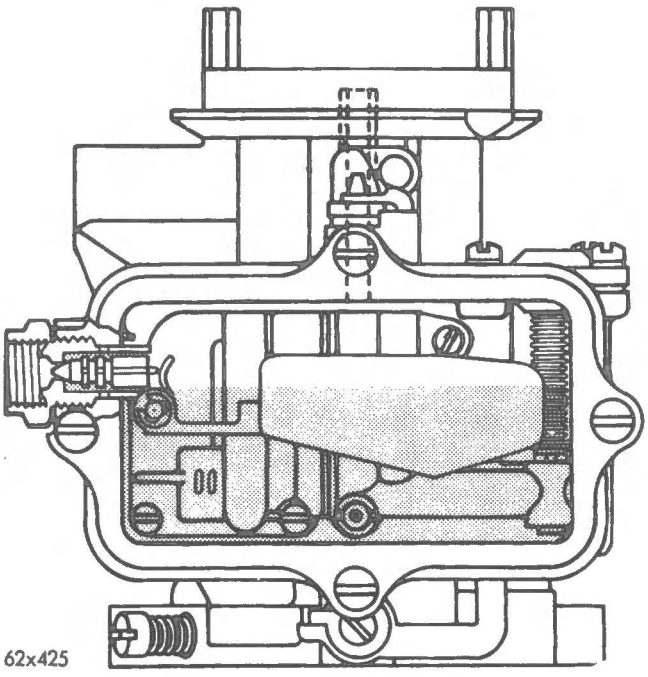


Fig. 3 - Fuel inlet and float system.

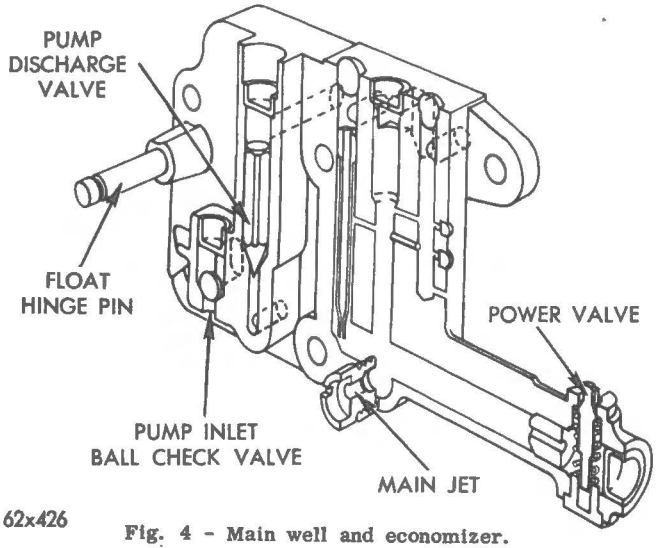


Fig. 4 - Main well and economizer.

Main Well and Economizer

Fuel passages of the four basic fuel metering systems originate in the main well and economizer body assembly in the carburettor fuel bowl, as shown in Fig. 4.

A study of the passages in this assembly will result in a clearer understanding of the explanations of the four fuel metering systems.

The Idle System .

At idle, fuel flows through the main jet into the main well then through a horizontal passage into the idle well. A restriction in the idle well is calibrated to flow the correct amount of fuel. The fuel passes out of the top of the idle well and into the idle system passages in the main body. The top of the vertical idle system passage in the main body contains the idle air bleed which admits a metered flow of air to the fuel. The fuel is discharged from the idle discharge hole into the manifold vacuum below the throttle plate. The pointed tip of the idle adjustment needle is set a short distance off its seat at the idle discharge hole. The setting of the idle adjusting needle controls the fuel air mixture discharge at idle, thus providing a means of adjusting the idle mixture, as shown in Fig. 5.

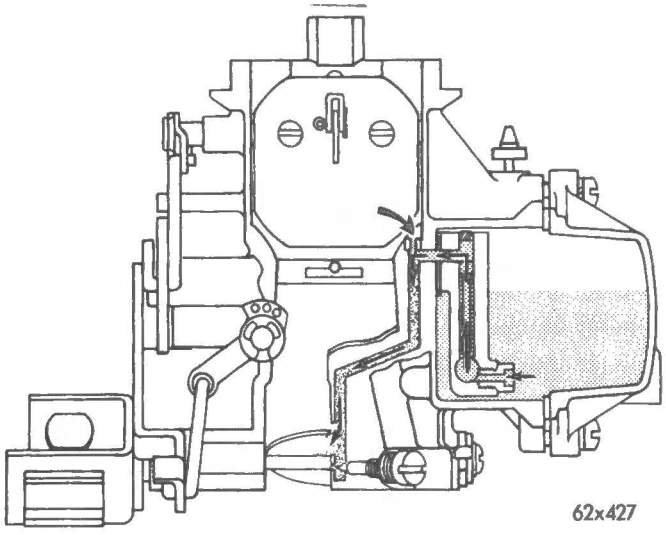


Fig. 5 - Idle system.

During off-idle operation, the throttle plate is moved slightly past the transfer slot, which begins discharging fuel as it is exposed to manifold vacuum. As the throttle plate is opened still wider and engine speed increases, the air flow through the carburettor is also increased.

This creates a vacuum in the venturi strong enough to bring the main system into operation. The flow from the idle system tapers off as the main system begins discharging. This allows a smooth transition from idling to cruising speeds.

Main Metering System

At normal cruising speeds, the difference in pressure between the normal air pressure in the fuel bowl and the vacuum in venturi, forces a metered flow of fuel from the fuel bowl through the main metering system and out of the main nozzle, which is located in the venturi. The fuel is metered by the main jet as it flows into the main well.

The fuel moves up the main well past narrow air bleed passages. Filtered air from the carburettor air inlet passes through the high speed bleed into the air bleed well, and enters the fuel flow in the main well through short horizontal air bleed passages.

This emulsion of fuel and air being lighter than solid fuel, responds faster to any change in venturi vacuum. It also vapourizes more readily than solid fuel when it is discharged.

The fuel continues up the main well and flows into the nozzle bar of the carburettor. Located on each side of the nozzle bar are the main discharge nozzles. Distribution pins, located in each of the main discharge nozzles, diverts the air flow in the carburettor to aid in providing further distribution of the mixture to all cylinders of the engine, as shown in Fig. 6.

The throttle plate controls the amount of fuel air mixture admitted to the intake manifold, regulating the speed and power output of the engine in accordance with accellerator pedal movement.

Power Enrichment System

During periods of increased road loads, of high speed operation, the ratio of fuel to air must increase for added power. The additional fuel required during this period is supplied by the power enrichment system.

The power system is controlled by manifold vacuum, which gives an accurate indication of the power demands on the engine. Manifold vacuum is transmitted from an opening in the throttle body below the throttle plate, through a passage in the throttle body and main body to the vacuum chamber above the diaphragm.

At idle and normal speed, the manifold vacuum is great enough to hold the diaphragm up against the tension of the diaphragm spring. This raises the diaphragm stem clear of the power valve.

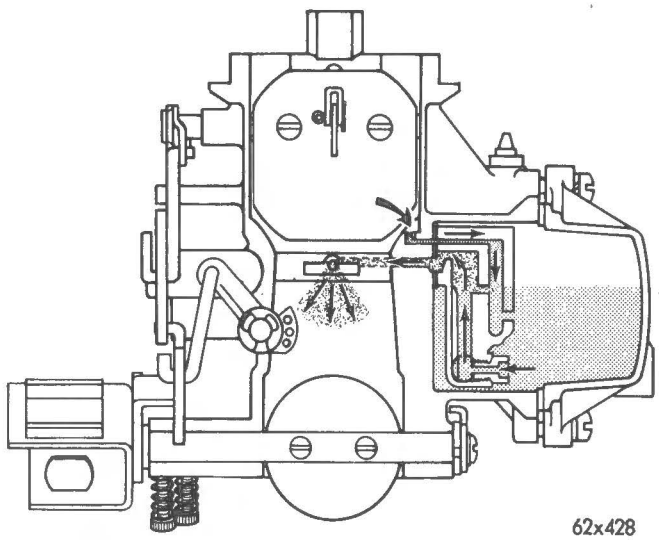


Fig. 6 - Main metering system.

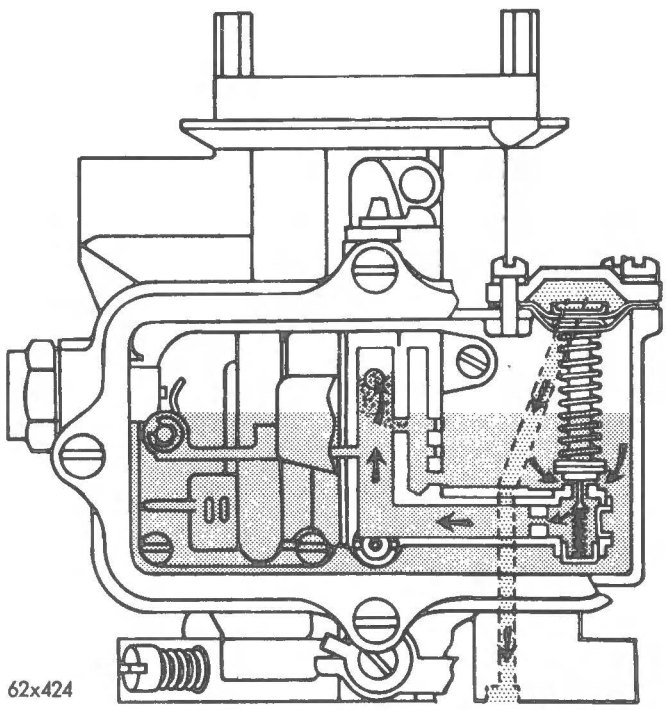


Fig. 7 - Power enrichment system.

The power valve is held closed by the tension of its spring, as shown in Fig. 7.

When the demand for engine power is increased, manifold vacuum is reduced. When the vacuum drops below a predetermined level, the diaphragm can no longer overcome the tension of the diaphragm spring and the diaphragm stem is forced down on the power valve. This depresses the pin in the centre of the valve, opening the valve. Fuel from the fuel bowl flows into the power valve. From the valve the fuel passes through a restriction and then into a horizontal passage which leads to the main well. Here the fuel is added to the fuel from the main system.

Accelerating Pump System

Upon accelleration, the air flow through the carburettor responds almost immediately to the increased throttle opening. There is, however, a brief interval before the fuel, which is heavier than air, can gain speed and maintain the desired balance of fuel and air. The accellerating system operates during this interval to supply fuel until the other systems can provide the correct mixture.

When the throttle is suddenly opened, the diaphragm which is connected by linkage to the throttle, forces fuel from the accellerating pump chamber into the discharge passage.

The fuel which is under pressure, forces the discharge needle check up. The fuel then passes out of the discharge nozzle where it is sprayed into the air stream of the venturi, as shown in Fig. 8.

When the throttle is closed, the return spring forces the diaphragm toward the back of the chamber, drawing fuel into the chamber through the inlet. A ball check in the inlet opens to admit fuel from the fuel bowl and closes when the accellerating pump is operated to prevent a reverse flow of fuel. The discharge needle check prevents air from entering when the diaphragm draws fuel into the chamber.

Automatic Well Type Choke

The operation of the automatic choke is based upon the combination of intake manifold vacuum, a vacuum operated piston, an offset choke valve and a thermostatic coil spring, located within the intake manifold and connected to the choke lever by a rod as shown in Fig. 9.

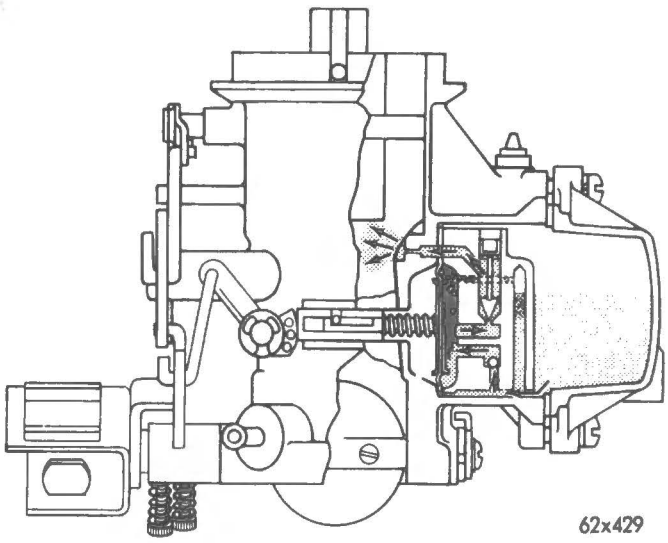


Fig. 8 - Accellerating pump system.

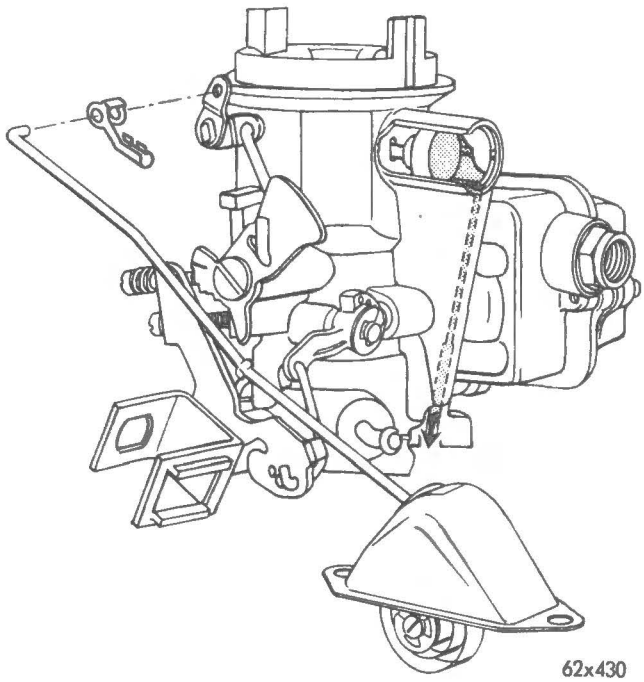


Fig. 9 - Automatic well type choke.

Heat from the manifold governs the tension of the thermostatic coil spring. The fast idle cam operates in conjunction with the automatic choke mechanism, to provide the correct throttle opening to prevent the engine from stalling during the warm-up periods.

As the engine temperature increases the opening of the choke plate is determined by the air flow against the offset portion of the choke plate. Heat from the manifold gradually decreases the tension of the bimetallic spring, until it offers no further resistance to the opening of the choke plate. When the engine reaches normal operating temperature and the accellerator is released, the fast idle cam rotates to its fully released position. In this position, the throttle plate opening is controlled by the curb idle speed screw.

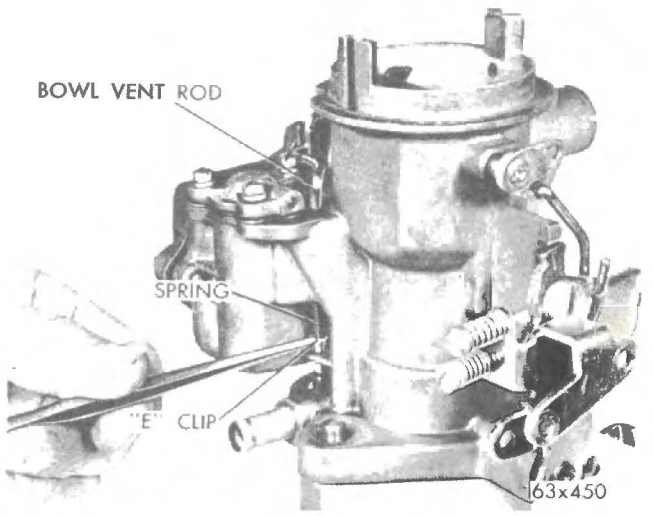


Fig. 11 - Removing or installing bowl vent rod clip.

1. SERVICING THE CARBURETTOR

When overhauling the carburettor, several items of importance should be observed to assure a good job.

(1) All parts should be carefully cleaned in a suitable solvent, then inspected for damage or wear.

(2) Use air pressure only, to clear the various orifices and channels.

(3) Replace questionable parts with new ones. When checking parts removed from carburettor, it is at times rather difficult to be sure they are satisfactory for further service. It is, therefore recommended that in such cases, new parts be installed.

(4) Always use a complete repair kit when overhauling the carburettor. Using the code number stamped on the flat surface next to the fast idle adjusting screw, refer to the parts catalogue for the correct repair kit for the carburettor being overhauled.

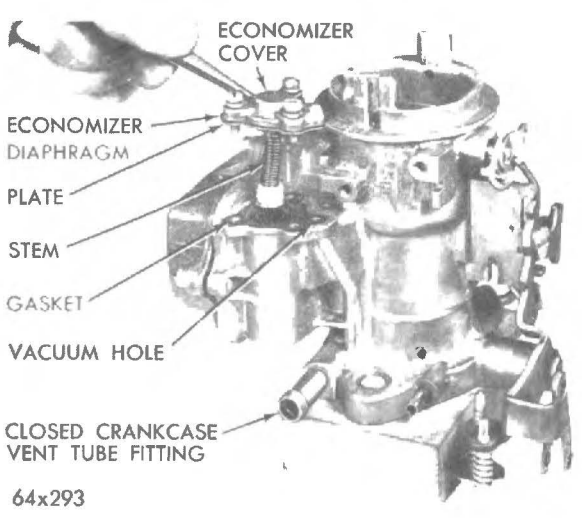


Fig. 12 - Removing or installing economizer.

2. DISASSEMBLING THE CARBURETTOR

To disassemble the carburettor for cleaning or overhauling, refer to Figs. 2 and 10 then proceed as follows:

(1) Place the carburettor assembly on repair stand Tool C-3886.

(2) Using needle nosed pliers, remove the bowl vent rod retaining clip, as shown

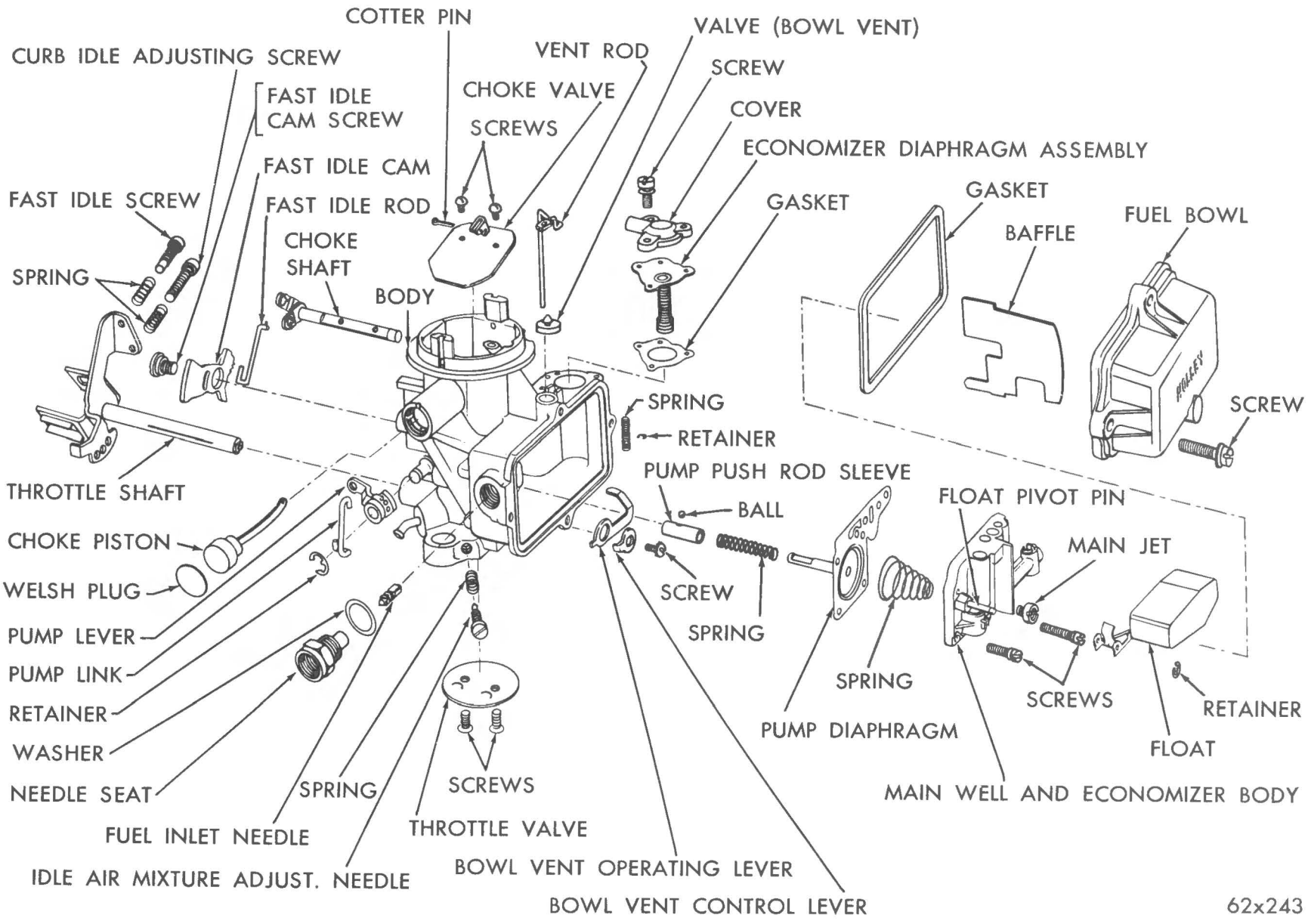


Fig. 10 - Carburettor assembly (exploded view).

in Fig. 11. Slide the bowl vent rod, bowl vent valve out of the carburettor. Remove spring.

(3) Using a 5/8" wrench, remove the fuel inlet needle valve and seat.

(4) Remove the economizer retaining screws then lift economizer cover, diaphragm and stem out of the carburettor, as shown in Fig. 12.

(5) Remove the fuel bowl attaching screws, then remove the fuel bowl, baffle, and gasket, as shown in Fig. 13. Slide baffle out of bowl. Discard the gasket.

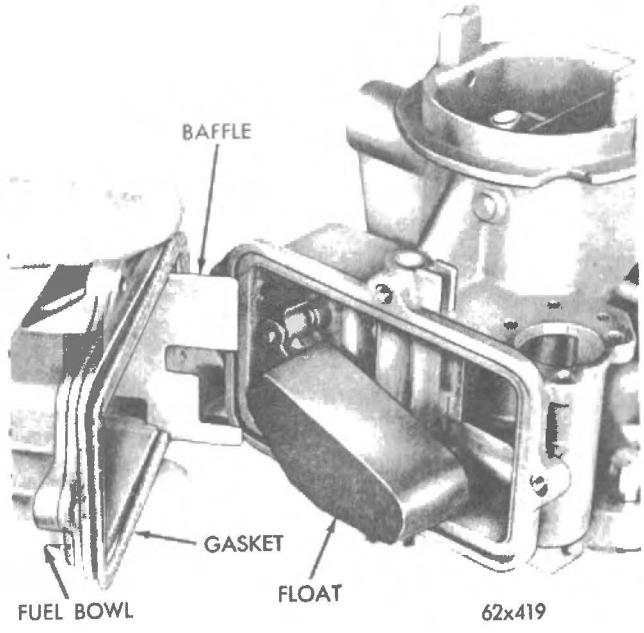


Fig. 13 - Removing or installing fuel bowl.

(6) Remove spring from float arm. Using a suitable tool, remove the float retaining clip, then slide float off the fulcrum pin, as shown in Fig. 14.

(7) Remove the screws that attach the economizer body and plugs, then remove the economizer body as shown in Fig. 15. Lift out the pump return spring.

(8) Slide the pump diaphragm and spacer assembly out of the fuel bowl, (Fig. 16).

(9) To disassemble the pump diaphragm, compress the spacer slightly toward the diaphragm until the ball drops out. Slide spacer and spring off the diaphragm stem (Fig).

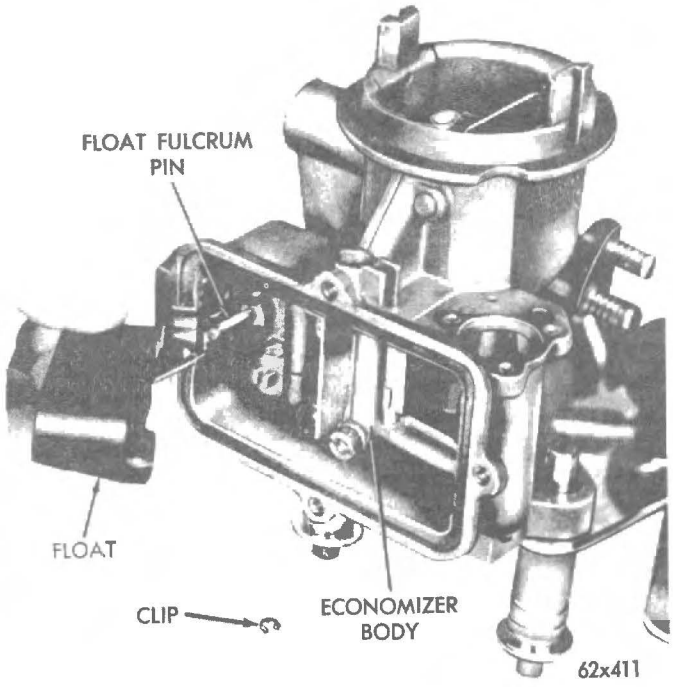


Fig. 14 - Removing or installing float.

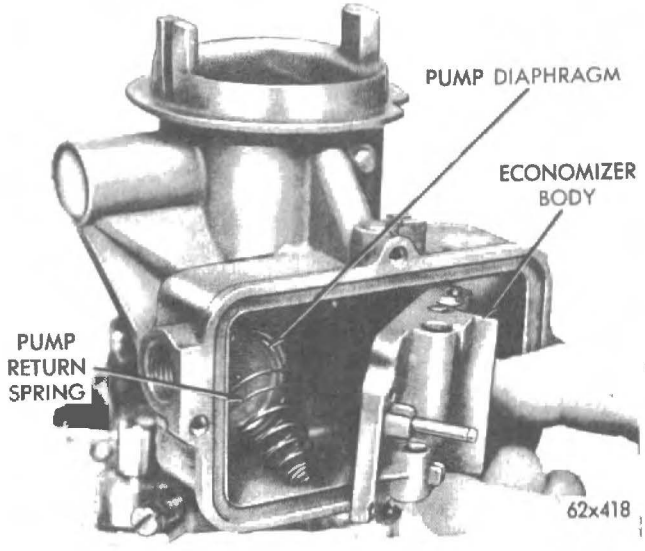


Fig. 15 - Removing or installing economizer body.

(10) Using Tool C-3748, remove the main jet from the economizer body (Fig. 18).

(11) Using a suitable tool, remove the pump cam retaining clip. Slide cam off pivot and disengage link from throttle lever (Fig. 19).

(12) Remove the fast idle cam retaining screw, then remove cam, and at the same time, disengage the choke link (Fig. 20).

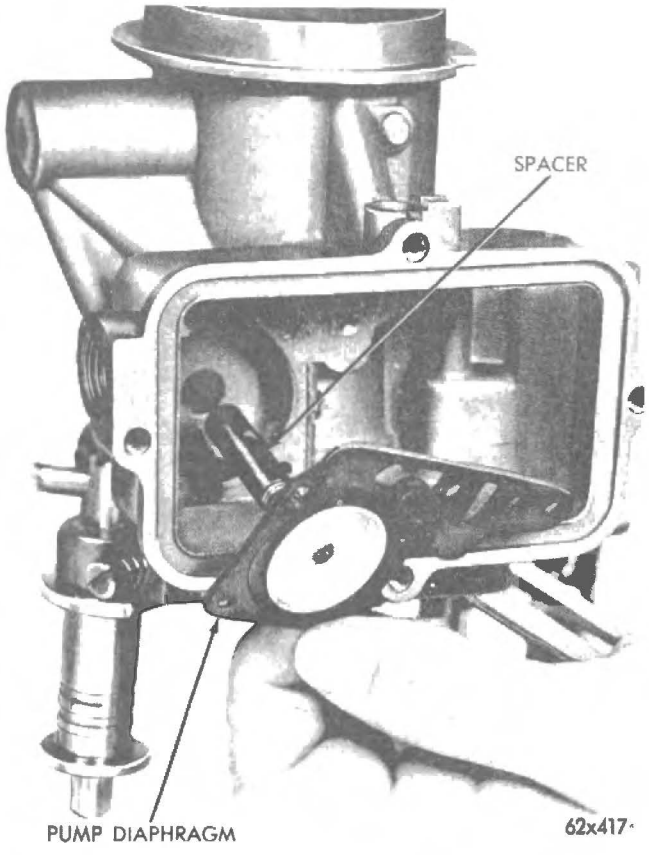


Fig. 16 - Removing or installing pump diaphragm and stem.

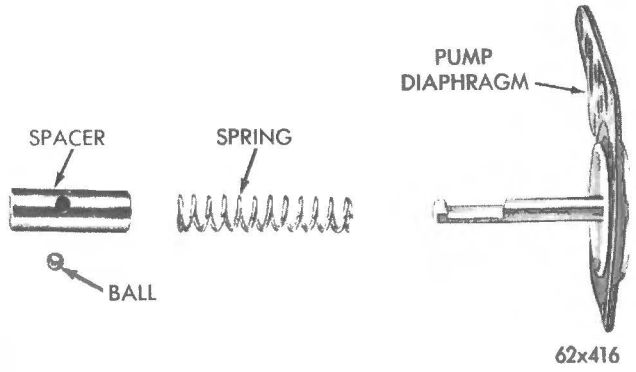


Fig. 17 - Pump diaphragm (exploded view).

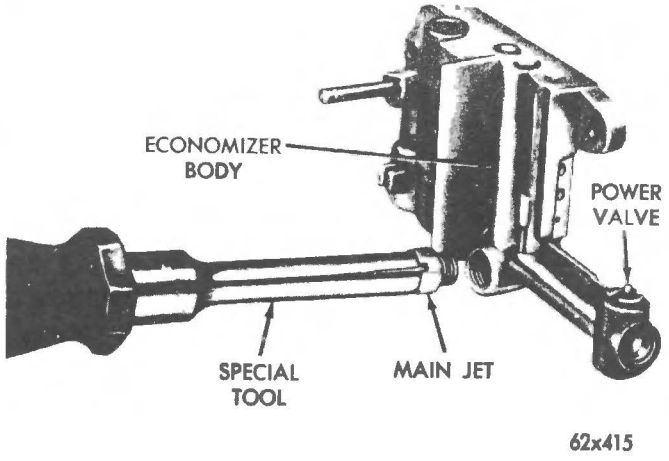


Fig. 18 - Removing or installing the main jet.

(13) Remove the idle air mixture adjusting screw and spring from the throttle flange.

(14) Remove the fast idle and curb idle speed screws and springs from the throttle lever.

(15) Invert the carburettor and remove the bowl vent operating lever and dog retaining screw, then remove lever and dog, from the end of the throttle shaft (Fig. 21).

(16) Remove the cotterpin that connects the choke piston link to the choke valve. Disengage link from bracket.

(17) Remove the screws that hold the choke valve and the choke piston link bracket to the choke shaft. These screws are staked to prevent loosening, and extreme care is necessary to avoid breaking off in choke shaft.

(18) Lift out the choke valve and link bracket. Withdraw the choke shaft and lever out of the carburettor.

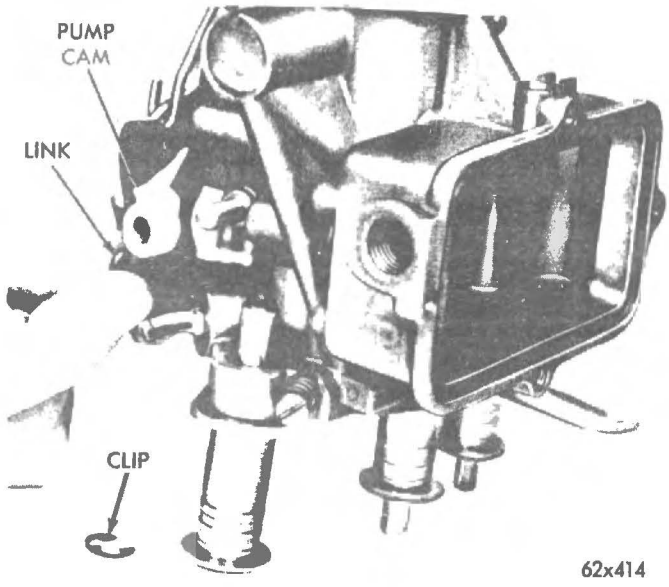


Fig. 19 - Removing or installing the pump cam and link.

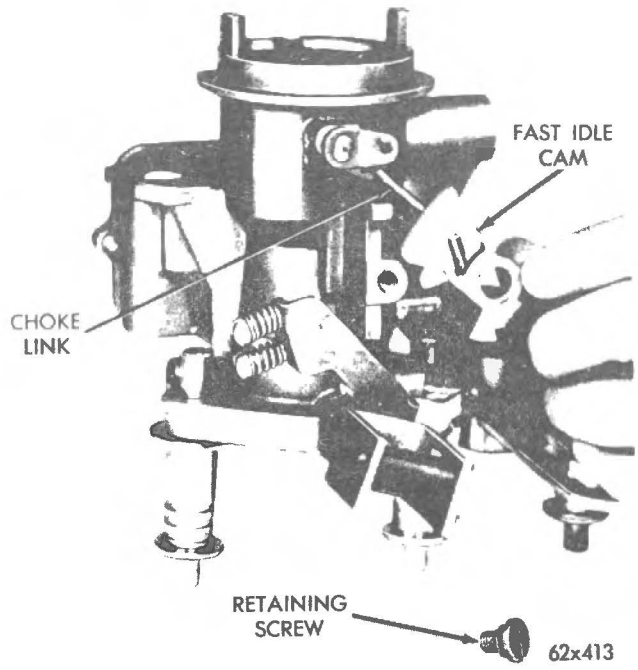


Fig. 20 - Removing or installing fast idle cam.

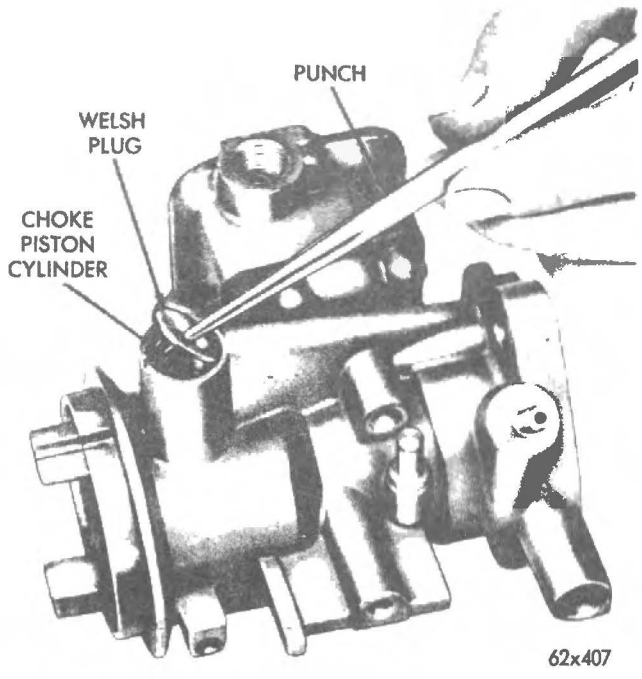


Fig. 22 - Removing choke piston welch plug.

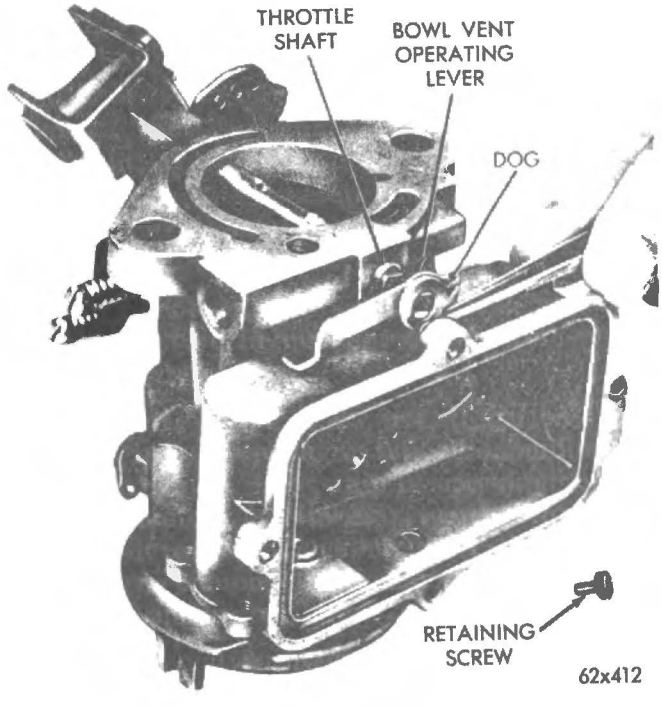


Fig. 21 - Removing or installing bowl vent operating lever.

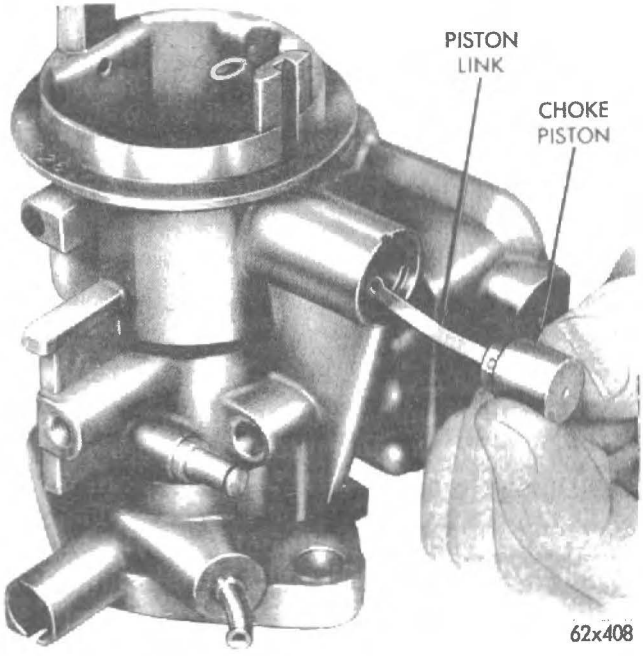


Fig. 23 - Removing or installing choke piston.

(19) Using a sharp punch, pierce the centre of the choke piston welch plug, then remove plug (Fig. 22).

(20) Slide the choke piston and link out of its cylinder (Fig. 23).

The carburettor assembly has now been disassembled as far as necessary for cleaning and inspection. It is usually not advisable to remove the throttle shaft and valve from the throttle flange, unless wear or damage necessitates the installation of new parts.

3. CLEANING CARBURETTOR PARTS

The recommended solvent for gum deposits is denatured alcohol which is easily obtainable. However there are other commercial solvents which may be used with satisfactory results.

IMPORTANT: If the commercial solvent recommends the use of water as a rinse, it should be hot. After rinsing, all trace of water must be blown from the passages with air pressure. It is further advisable to rinse all parts in clean kerosene or petrol to be certain no trace of moisture remains. Never clean jets with a wire, drill, or other mechanical means, because orifices may become enlarged, making the mixture too rich for good performance.

4. INSPECTION AND REASSEMBLY

Throttle Body

(1) Check the throttle shaft for excessive wear in the throttle body. If wear is extreme, it is recommended that the carburettor assembly be replaced rather than installing a new shaft in the old body.

During manufacture, the location of the idle transfer port and spark advance control ports to the throttle valve is carefully established for one particular assembly.

If a new shaft should be installed in an old, worn, throttle body, it would be very unlikely that the original relationship of ports to the valve would be obtained. Changing the relationship of the valve to ports would adversely affect normal car operation between speeds of 15 and 30 miles per hour. However, if it has been determined that a new shaft or valve is to be installed, adhere to the following instructions:

(2) Mark the position of the throttle valve in the bore.

(3) Remove the screws that hold the throttle valve to the shaft, then slide the valve out of the bore.

CAUTION: These screws are staked on the opposite side and care should be used at removal so as not to break in the shaft.

(4) Slide the throttle shaft out of the throttle body.

(5) Install new throttle shaft and lever (or new valve).

(6) Install new screws but do not tighten. Hold the valve in place, with the fingers pressing on the high side of the valve. Tap the valve lightly with a screwdriver, to seat in the throttle bore. Now tighten the screws securely and stake by squeezing with pliers.

(7) Install the idle mixture screw and spring in the throttle body. (The tapered portion must be straight and smooth, if it is grooved or ridged, a new idle mixture screw should be installed to ensure having correct idle mixture control). Do not use a screwdriver. Turn the screw lightly against its seat with the fingers. Back off one full turn for approximate adjustment.

Assembling the Carburettor

(1) Slide the choke piston and link into the piston cylinder, with the piston link arc, uppermost (Fig. 23). Install new welch plug and seat by rapping with a ball-pene hammer on the centre of the plug.

(2) Slide the choke shaft into position, then install the choke valve and link bracket. Install the attaching screws but do not tighten.

Check the choke valve for binding by rotating the choke lever through the extent of its travel. If operation is smooth, without binding, tighten the choke valve screws

securely. Stake by squeezing with pliers.

(3) Install the fast idle and curb idle speed screws and springs in the throttle lever.

(4) Refer to Fig. 17, then slide the pump diaphragm spacer spring over the diaphragm stem, followed by the spacer.

Compress spring and spacer far enough to install the ball to secure.

(5) Install the main jet in the economizer body using Tool C-3748 (Fig. 18).

(6) Slide the pump diaphragm and stem into position in the carburettor, then install the pump return spring (Figs. 16 and 15).

(7) Turn carburettor with bowl opening up then position the main well and economizer body in the carburettor (Fig. 15). Install screws and tighten securely. Be sure the pump spring is correctly centred.

(8) Engage the pump cam link with the cam and throttle lever, then install cam and secure with clip (Fig. 19). When installing the link, be sure link is in the centre hole of throttle lever.

(9) Engage the choke link with the choke lever and fast idle cam. Place cam in position, then install retaining screw. Tighten screw securely.

(10) Position the bowl vent operating lever and dog on the end of the throttle shaft and secure with retaining screw (Fig. 21).

(11) Slide the float into position over the fulcrum pin and secure with retainer clip (Refer Fig. 14). Install float damping spring.

(12) Install the fuel inlet needle, seat and new gasket. Tighten seat securely. Check float setting as follows:

Checking Float Setting

With carburettor inverted, slide the float gauge CA-3903 into position and check the setting on the "touch" leg of the gauge (Fig. 24). The float should just touch the gauge. Reverse the gauge and check the "no touch" leg. The float should just clear the gauge.

If an adjustment is necessary, bend the float tab (which touches the head of the fuel inlet needle) using needle nosed pliers. Do

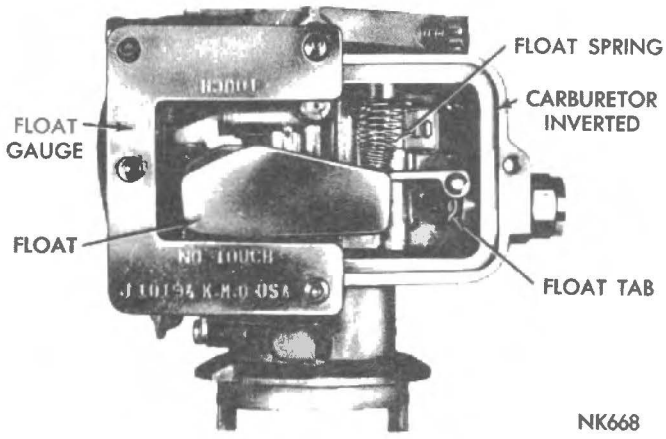


Fig. 24 - Checking float setting.

not allow the float tab to contact the float needle head during this operation as the synthetic rubber tip of the needle can be compressed, giving a false setting.

Re-check float setting as described above after re-adjustment.

(13) Slide the economizer diaphragm and stem assembly into position, making sure the vacuum holes are aligned. Install cover and retaining screws. Raise diaphragm stem approximately half its travel to relieve diaphragm tension. Tighten screws evenly (Fig. 12).

NOTE: Failure to relieve diaphragm tension could result in damage to the diaphragm with subsequent economizer valve malfunction.

Test economizer valve as outlined on Page 2 4.

(14) Slide the baffle into position in the fuel bowl, now place the fuel bowl gasket on the cover. Place the fuel bowl in position, install screws and washers and tighten alternately. (Be sure gasket is sealed in the recess section of the main body).

Tighten the screws gently so as to compress only the lockwasher. Screws drawn down too tightly could distort the fuel bowl and cause a leak.

(15) Slide the bowl vent rod down into position, at the same time thread the spring over rod. Secure with clip (Fig. 11).

5. CARBURETTOR ADJUSTMENTS

It is very important that the following adjustments be made on a reconditioned carburettor, and in the sequence listed.

Fast Idle Cam Adjustment Position

For Models

R-2767A **R-2887A**
R-2768A **R-2888A**

(1) Position the fast idle screw on the first step of the cam (refer Fig. 25).

(2) Apply a light closing pressure to the choke valve and insert a 15/64" drill between the choke valve and the air horn. A slight drag on the drill indicates correct adjustment.

(3) To adjust, bend the fast idle rod using Tool T109-213 until the correct valve opening has been obtained (refer Fig. 25).

NOTE: When the correct fast idle cam position adjustment has been made, the choke unloader (wide open kick) adjustment has also been obtained.

For Models

R-2535A
R-2536A

To index the fast idle cam (carburettor removed), refer to Fig. 29 then proceed as follows:

(1) Open the throttle valve and hold the choke valve in the fully closed position. This will position the fast idle cam at fast idle index position.

(2) Now close the throttle valve. The index mark on the cam should split the centre of the fast idle adjusting screw (Fig. 29).

If an adjustment is necessary, bend the fast idle connector rod at an angle using Tool T-109-213 until the index mark on the cam indexes with the fast idle adjusting screw.

The final fast idle speed adjustment must be made with the carburettor installed on the engine.

The correct fast idle cam indexing also positions the choke unloader (or wide open kick). No further adjustment is required.

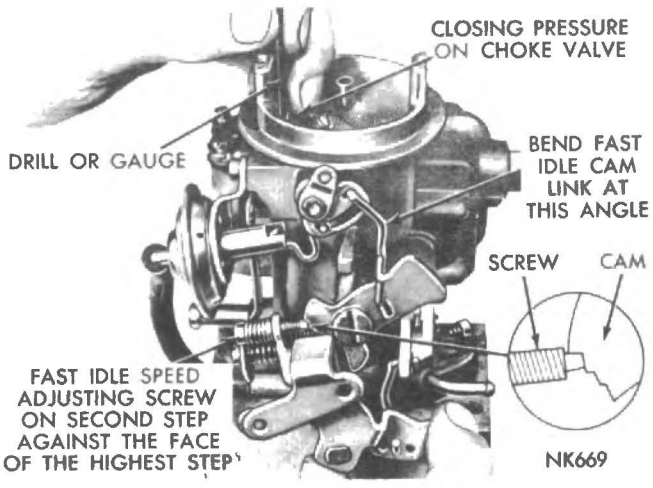


Fig. 25 - Fast Idle Cam Position Adjustment.

Vacuum Kick Adjustments

For Models

R-2767A	**R-2887A**
R-2768A	**R-2888A**

This adjustment can be made ON or OFF the vehicle. To make the vacuum kick adjustment, the vacuum diaphragm must be energised (either by a distributor testing machine with a vacuum source, or a vacuum supplied by another vehicle).

(1) Test the choke diaphragm for leakage as follows:

(a) Depress the diaphragm stem, place finger over the end of the hose stem opening, then release the diaphragm stem.

(b) If there are no internal leaks the diaphragm stem will not move. If the stem moves more than 1/16" in ten (10) seconds, the leakage is excessive and the diaphragm must be replaced.

(c) With the carburettor installed on the engine and the engine running, check for adequate vacuum at the diaphragm by removing the hose from the diaphragm stem and holding a finger over the end of the hose.

(2) With the engine NOT running, open the throttle valve far enough to allow the choke valve to be moved to the closed position.

(3) Disconnect the vacuum hose from the diaphragm and connect the hose from the vacuum supply, as shown in Fig. 26 (a minimum of 10 inches of mercury will be required).

(4) Insert a number drill or gauge between the choke valve and the wall of the air horn while applying a light closing pressure to the choke valve (refer Fig. 26). Use a No. 6 drill, (13/64") or gauge T109-39 for R-2767A, R-2887A carburettors, and gauge T109-154 or a No. 23 drill, (5/32") for R-2768A, R-2888A carburettors.

(5) An adjustment is necessary, if a slight drag is not felt as the drill or gauge is being removed. The adjustment of this opening will require the removal of the choke operating link.

CAUTION: Damage to the diaphragm and the choke lever slot can result, if the link is not removed for the bending operation.

(6) Remove the "E" clip and disengage the choke operating link from the diaphragm stem (plunger), then disengage the link from the choke lever. (The best bending results will be obtained by using a vice and a pair of pliers.)

(7) Bend the choke operating link at the angle to provide the correct valve opening.

NOTE: A correction in the length of the link of .010" will result in a change of .010" in the choke valve opening.

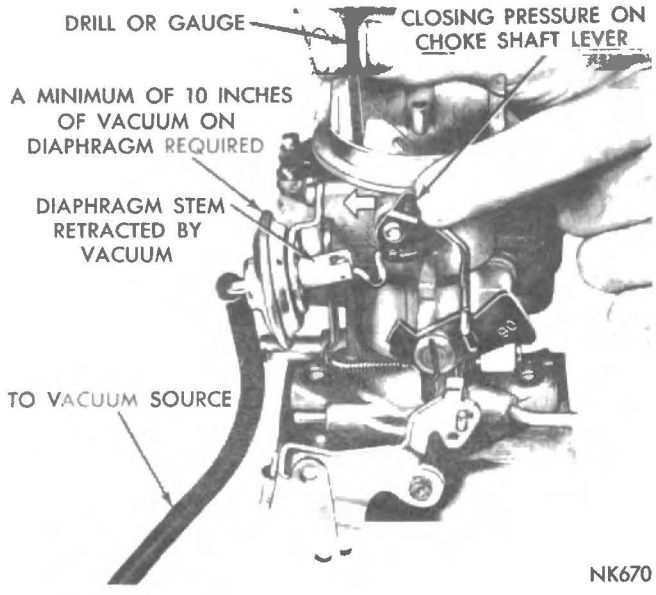


Fig. 26 - Measuring the Choke Vacuum Kick Setting.

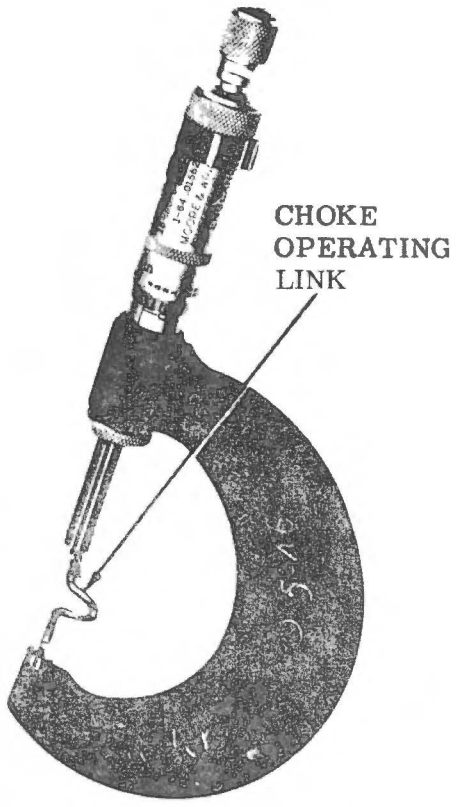


Fig. 27 - Choke Operating Link Measurements.

A 2 inch micrometer will be helpful in establishing the original length of the link, as shown in Fig. 27 before completing the adjustment.

(8) Install the choke operating link and retest the choke valve opening, using a gauge or drill (refer Fig. 26). Reinstall the vacuum hose to the diaphragm fitting and make the following test:

(9) With no vacuum supplied to the diaphragm, some clearance should exist between the choke operating link and the choke lever slot, in both the open and closed choke valve positions, as shown in Fig. 28.

NOTE: This clearance is necessary to allow the choke valve to close for starting and to fully open, after the engine reaches the normal operating temperature.

If a clearance does not exist in both of these positions, a retest of the operating link should be made.

NOTE: Free movement of the choke valve between the closed and open positions is most necessary.

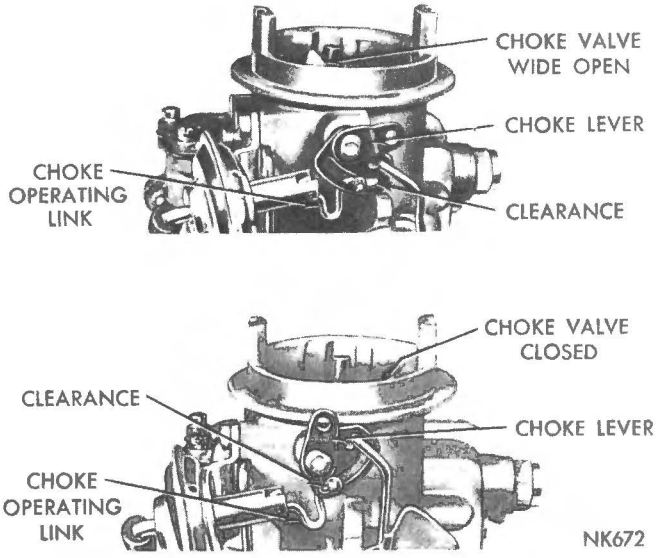


Fig. 28 - Choke Operating Link Clearances.

Idle Speed Adjustment (Curb Idle)

To make the idle speed adjustment, the engine must be thoroughly warmed up. A much more reliable idle adjustment can be obtained if the car has been driven a minimum of five miles. For the best results, it is recommended that a tachometer be used in this adjustment. (Before making the idle speed adjustment, observe the following precautions):

Because the alternator can charge at idle speeds, and impose a load on the engine, the headlights should be turned on. This will assure setting the idle to compensate for the alternator load. On cars equipped with

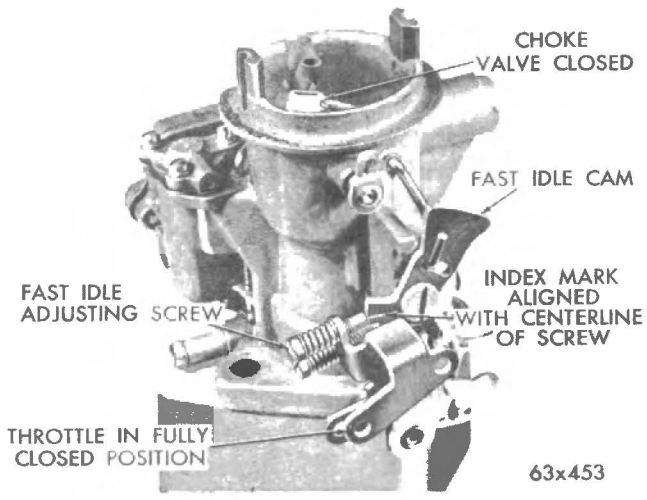


Fig. 29 - Fast idle index mark aligned.

automatic transmission, unsnap the ball joint connection at the accellerator shaft bell crank. If this is not done, it is possible that the carburettor throttle will be held open against the stop in the transmission. The carburettor would therefore not respond to adjustment of the idle speed screw. After the correct idle speed has been obtained at the carburettor, screw the ball joint connector up or down until the ball on the bell crank will exactly mate with the socket. Snap into place. To make the idle speed adjustment, proceed as follows:

(1) Turn the idle speed screw in or out to obtain 550 R. P. M. (Be sure that the choke valve is fully open and that the fast idle adjusting screw is not contacting the cam).

(2) Adjust the idle mixture screw to obtain the highest R. P. M. Whilst making the adjustment, carefully watch the tachometer and notice that the speed can be decreased by turning the screw in either direction from the setting that gave the highest R. P. M. reading.

(3) From the highest idle speed setting, turn the mixture clockwise (leaner) until the speed starts to drop. Turn the screw in the opposite direction (counter-clockwise) just far enough to recover the speed that was lost. This procedure will ensure that the idle has been set to the leanest mixture possible for smooth idle.

This setting is very important. Since the correct speed was originally set using the speed screw, the speed obtained after finding the leanest smooth idle setting will probably be too fast.

(4) Re-adjust the speed screw to obtain correct idle speed. Repeat steps 2 and 3 above.

Fast Idle Speed Adjustment

For Models

R-2535A
R-2536A

To set the fast idle speed, connect a tachometer, then proceed as follows:

(1) With the engine warmed up and running, open the throttle slightly, and rotate the fast idle cam until the fast idle adjustment screw will contact the second step of the fast idle cam.

(2) Release the throttle. The linkage pull back spring will cause the fast idling screw to hold the cam in this position.

(3) Turn the fast idle speed adjusting screw clockwise (faster) or counter-clockwise (slower) to obtain the fast idle speed shown in the specifications.

For Models

R-2767A **R-2887A**
R-2768A **R-2888A**

To set the fast idle speed on the vehicle connect a tachometer to the vehicle, then set the curb idle speed and proceed as follows.

(1) With the engine running and the transmission in neutral, open the throttle slightly.

(2) Close the choke valve approximately 20 degrees then allow the throttle to close. Return the choke valve to the open position.

(3) The fast idle speed adjusting screw should contact the lowest step on the fast idle cam, as shown in Fig. 30.

(4) With the engine warmed up to the normal operating temperature, turn the fast idle speed adjusting screw IN or OUT to obtain the fast idle speed shown in the specifications. Reposition the cam and throttle after every screw adjustment.

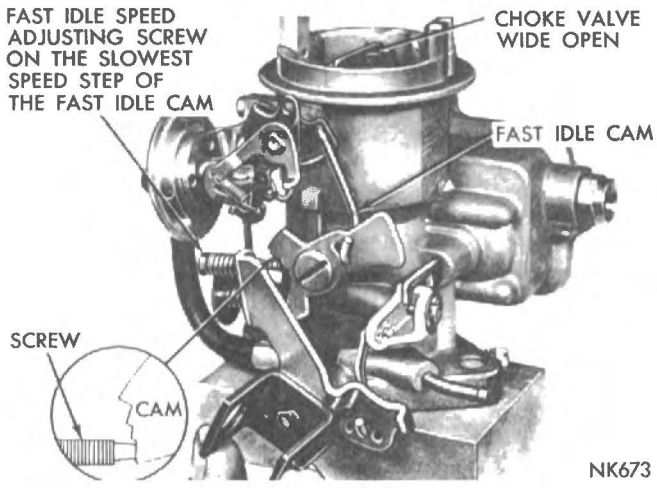


Fig. 30 - Fast Idle Speed Adjustment.

Economizer Valve Adjustment

(1) With the engine stopped, remove the carburettor float chamber.

(2) Blank off the carburettor base with a suitable plate and gasket.

(3) Disconnect choke unloader vacuum hose from base of carburettor.

(4) Connect source of vacuum to choke unloader vacuum tube at carburettor base.

(5) Apply vacuum and note reading when economizer valve closes.

(6) Release vacuum and note reading when economizer valve opens.

(7) Economizer valve should open at 4 - 6" of mercury.

(8) If adjustment is necessary remove or install nylon washers under spring to obtain correct vacuum reading.

Bowl Vent Adjustment

With the throttle valve at curb idle speed, it should be possible to insert the correct drill between the bowl vent and the seat, as shown in Fig. 31 (see specifications).

If adjustment is necessary, bend the tab on the operating arm until correct clearance has been obtained, or bend the vent rod at the horizontal portion above bowl. Be sure vent rod does not bind in the guide.

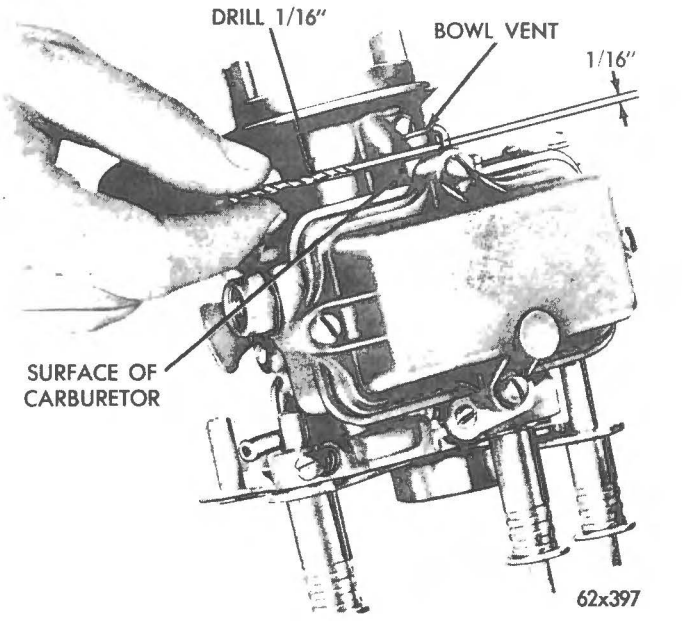


Fig. 31' - Checking bowl vent opening.

6. AUTOMATIC CHOKE (WELL TYPE)

To function properly, it is important that all parts be clean and move freely. Other than an occasional cleaning, the choke requires no servicing. However it is very important that the choke control unit works freely in the well and at the choke shaft.

Move the choke rod up and down to check for free movement on the pivot. If the unit binds, a new choke unit should be installed. The well type choke unit is serviced as an assembly. Do not attempt to repair, or change setting. The correct setting is with the index notch opposite the appropriate calibration mark.

When installing the well type choke unit, be certain that the coil housing does not contact the sides of the well in the exhaust manifold.

Any contact at this point will affect choke operation. Do not lubricate any parts of the choke or the control unit. This causes an accumulation of dirt, which will result in binding of the mechanism.

7. CLOSED CRANKCASE VENTILATION

The closed crankcase ventilator valve is located in the outlet cap on the cylinder head cover, and connected by a tube between the outlet vent cap, and the lower part of the carburettor throttle body.

The function of the valve is to regulate the flow of crankcase ventilation at varying throttle positions. The system will operate effectively as long as normal maintenance is applied.

For servicing procedures for this system, refer to the Engine section (Group 9) of this manual.

8. THROTTLE LINKAGE ADJUSTMENT

Manual Transmission (Refer Fig. 32)

(1) Disconnect the choke at carburettor (4) or block choke valve in full open position. Open throttle slightly to release fast idle cam, then return throttle to curb idle.

(2) Disconnect top end of accelerator shaft to bellcrank rod (6). Adjust the length of this rod to provide correct pedal angle

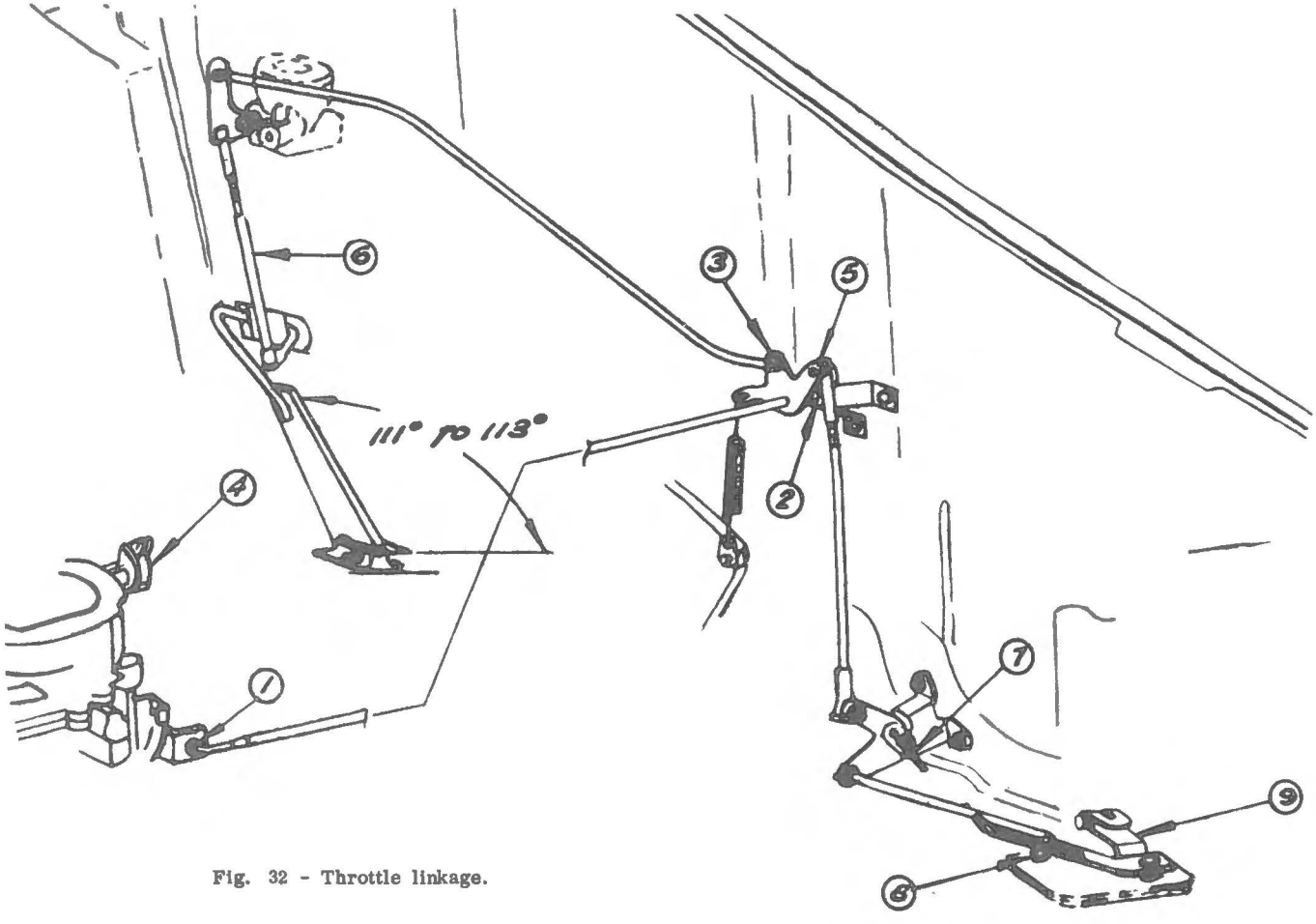


Fig. 32 - Throttle linkage.

(see specifications). To increase pedal angle, decrease the length of this rod by means of the screw adjustment. Re-install the top end of the rod (6). Connect choke rod (4) and remove blocking fixture.

Automatic Transmission

(1) Disconnect choke at carburettor (4) or block choke valve in full open position. Open throttle slightly to release fast idle cam, then return throttle to curb idle.

(2) With the lock nut (8) loose in the transmission rod, insert a 3/16" diameter rod (7) approximately 4" long in the holes provided in the transmission rod bellcrank bracket and lever assembly.

(3) Move the transmission lever (9) forward against the stop and tighten the transmission rod lock nut.

(4) Disconnect the top end of the accellerator shaft to bellcrank rod (6). Adjust the length of this rod to provide correct pedal angle (see specifications). To increase pedal angle, decrease the length of this rod by means of the screw adjustment. Re-install the top end of the rod (6).

(5) Remove the 3/16" diameter rod (7) from the transmission rod bracket and lever assembly. Adjust the length of the transmission bellcrank to torque shaft rod by means of screw adjustment at top end. The correct rod length allows the ball socket to line up with the ball end when the rod is held upward against the transmission stop.

(6) Install the ball socket on torque shaft lever ball end.

(7) Connect choke rod (4) or remove blocking fixture.

PART 2—CARTER CARBURETTOR

SPECIFICATIONS

CARBURETTOR

Type	Single Throat Down Draught	
Model		
Manual Transmission	BBS-3837S	
Automatic Transmission		BBS-3838S
Bore	$1\frac{11}{16}$"	
Venturi	$1\frac{11}{32}$"	
Main Metering Jet		
Standard	No. 120-263S	
One Step Lean	No. 120-267S	
Two Steps Lean	No. 120-268S	
Step-up Wire (Standard)	75-1650	75-1592
Diameter	.022"	028"
Adjustments		
Float Setting - (Initial needle and seat assembly)	$\frac{1}{4}$"	
(Replacement needle and seat assembly)	5/16"	
Choke Unloader	3/16"	
Fast Idle Cam Position	5/64"	
Vacuum Kick (drill size)	$\frac{1}{8}$"	No. 41
Bowl Vent Valve Setting (from under side of valve to air horn)	060"	
Idle Mixture Screw (turns open)	1	
Idle Speed R. P. M. (curb idle) (with headlights turned on)	550	
Fast Idle Speed R. P. M.	700	
Choke		
Control	Thermostatic Coil Spring	
Type	Well	
Setting	2 notches rich	

SPECIAL TOOLS

C-3225	Repair stand
T109-213	Bending Tool
T109-59T	Screwdriver bit (accellerator pump jet)
T109-43	Plug remover (pump jet)
T109-28	Choke unloader gauge
T109-239	Float Gauge

FUEL PUMP

Make	Carter
Model	MS-3674S
Type	Diaphragm
Number of Valves	2
Driven by	Camshaft
Pump Pressure	$3\frac{1}{2}$ - 5 p.s.i.

FUEL TANK

Location	Under Trunk Compartment
Capacity	14.3 Gallons imp.

GENERAL INFORMATION

The BBS series carburettor is a single throat downdraft carburettor. The float low speed, high speed and accellerator pump systems operate as follows:

Float System

The float system maintains a fuel supply at a constant level for all operating conditions. The fuel level is kept at a minimum to prevent as much fuel vaporisation as possible and to aid in warm engine starting. It is important that floats are properly adjusted, and needle valve assembly is in good condition. Equally important is a good seal between the air horn and main body. A poor gasket at this point causes leakage resulting in lowering of the fuel in the fuel bowl and might allow the entrance of dirt or other foreign material, which would result in poor performance.

Low Speed System

During engine idle or part throttle operation, fuel is supplied to the engine through the low speed system. Fuel enters the main metering jet and is metered through the idle orifice tube where it mixes with air drawn through the idle air bleed. The idle restriction breaks up the fuel as it mixes with air drawn through the idle air bleed. This provides an air-fuel mixture at the idle port and the idle bleed adjustment screw port.

It is important that the idle air bleed, idle orifice tube, idle restriction, idle passage, idle port and idle adjustment screw port are kept clean. Any clogging will result in poor low speed operation. Air leakage through the gaskets will also cause poor engine idling or low speed operation.

High Speed System

During part or full throttle operation, fuel is supplied to the engine through the high speed system.

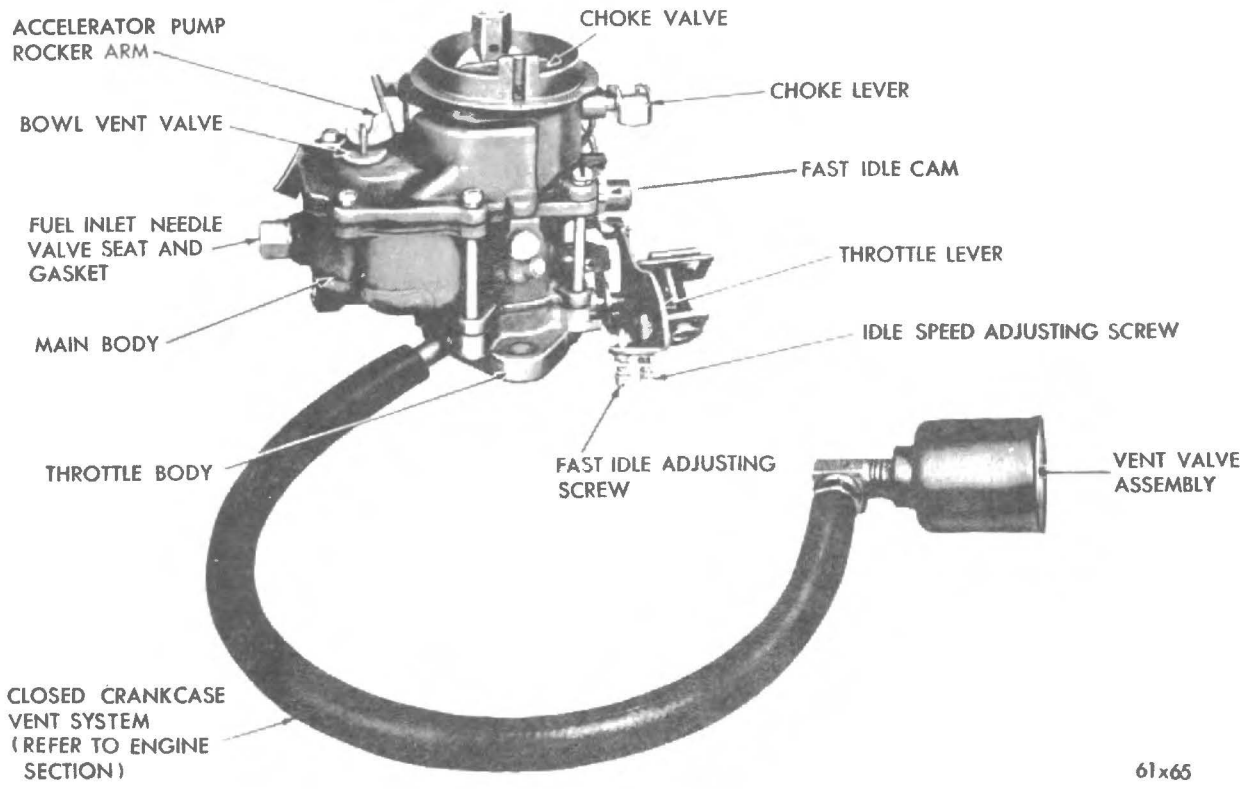


Fig. 1 —Carburettor assembly (BBS series) with closed crankcase vent (typical).

When the engine is under a heavy load, is suddenly accellerated or is operated at very high engine speed, the step-up system supplies additional fuel through the diffuser bar discharge port. Fuel flow through the fuel passage of the main metering jet is controlled by the movement of the step-up rod which in turn is moved by a spring and a vacuum-controlled piston. A vacuum passage to the intake manifold is provided for by a drilled passage in the carburettor and throttle body, and a slotted flange gasket.

Under normal driving conditions, the manifold vacuum exerts a strong pull on the vacuum piston. This holds the piston down keeping the step-up rod in the fuel passage of the main metering jet. Fuel then flows around the rod, through the jet, and through the diffuser bar discharge port.

When manifold vacuum falls off, due to a heavy load, sudden acceleration, or very high engine speed, the spring moves the piston up, moving the step-up rod out of the main metering jet fuel passage. Additional fuel is then supplied to the engine.

Air is drawn through the high speed air bleed and mixes with the fuel surrounding the main vent tube. The mixture is then drawn from the diffuser discharge ports. It is important that the vent tube is clean. A clogged tube may cause excessively rich mixtures. Leakage of air at the gaskets will decrease or destroy the vacuum and the step-up piston will remain up resulting in excess fuel consumption.

Accelerator Pump System

The accelerator pump system momentarily supplies an extra charge of fuel to the engine when the throttle is opened. The amount of fuel added is directly proportional to the amount the pedal is depressed. When the accelerator pedal is depressed, the pump plunger spring forces the plunger down and the fuel is discharged past the check ball through the jet and into the air stream. The inlet passage is closed by the inlet check ball as this occurs.

When the accelerator pedal returns, the pump plunger is pulled up drawing a new charge of fuel past the inlet check ball. The discharge check ball is closed, preventing air bleeding into the passage when the pump plunger is pulled up.

When the engine is operated at high speeds a vacuum exists at the accelerator pump jet. To prevent fuel being drawn out of the pump system, the pump jet air bleed is vented through a passage in the air horn to the float bowl.

A vent is provided also in the plunger to relieve vapour pressure developed by heat in the pump system.

Automatic Choke

The automatic choke on the carburettor is of the well type. The choke operates through a combination of linkage that connects the choke thermostatic coil spring to the offset choke valve, and a vacuum choke diaphragm. The thermostatic coil spring is located in a well directly over the exhaust passage in the exhaust manifold. The vacuum choke diaphragm is connected to the choke valve through a link and pin.

The heat generated in the well of the exhaust manifold, acts on the thermostatic coil spring so that as the engine warms up, the choke valve moves toward the open position. The position of the choke valve is further controlled by the action of manifold vacuum on the choke diaphragm.

The offset choke valve tends to position itself according to engine speed and load conditions, governed by the air flowing into the carburettor. The combination of these features provides the required choke mixture calibration for efficient operation.

To prevent choking a warm or hot engine, the heat retained by the exhaust manifold prevents the thermostatic coil spring from cooling off too quickly, thereby closing the choke valve while the engine is still hot. The choke is connected to the fast idle cam which provides the necessary increased idle speed during the warm up period.

SERVICE INFORMATION PROCEDURES

1. SERVICING THE CARBURETTOR

Often the carburettor is blamed for a great variety of trouble which is classed as poor car performance. Therefore, be sure that the trouble is not located elsewhere before disassembling the carburettor.

When overhauling the carburettor several items of importance should be observed to assure a good job:

(1) The carburettor must be completely disassembled.

(2) All parts should be cleaned in a suitable solvent then inspected for damage or wear.

(3) Use air pressure only, to clean the various orifices or channels.

(4) Replace questionable parts with new parts. When checking parts removed from the carburettor, it is at times difficult to be sure they are satisfactory for further service. It is therefore recommended that in such case, new parts be installed.

2. DISASSEMBLING THE CARBURETTOR

To disassemble the carburettor for cleaning or overhaul, refer to (Fig. 2) and proceed as follows:

(1) Place the carburettor assembly on repair block, Tool C-3225.

(2) Remove hairpin clip and disengage the accelerator pump operating rod.

(3) Remove the vacuum hose between the carburettor or main body and the vacuum diaphragm.

(4) Remove the clip from the choke operating link and disengage the link from the diaphragm plunger (stem) and the choke lever.

(5) Remove the vacuum diaphragm and bracket assembly and place to one side to be cleaned as a special item. A liquid

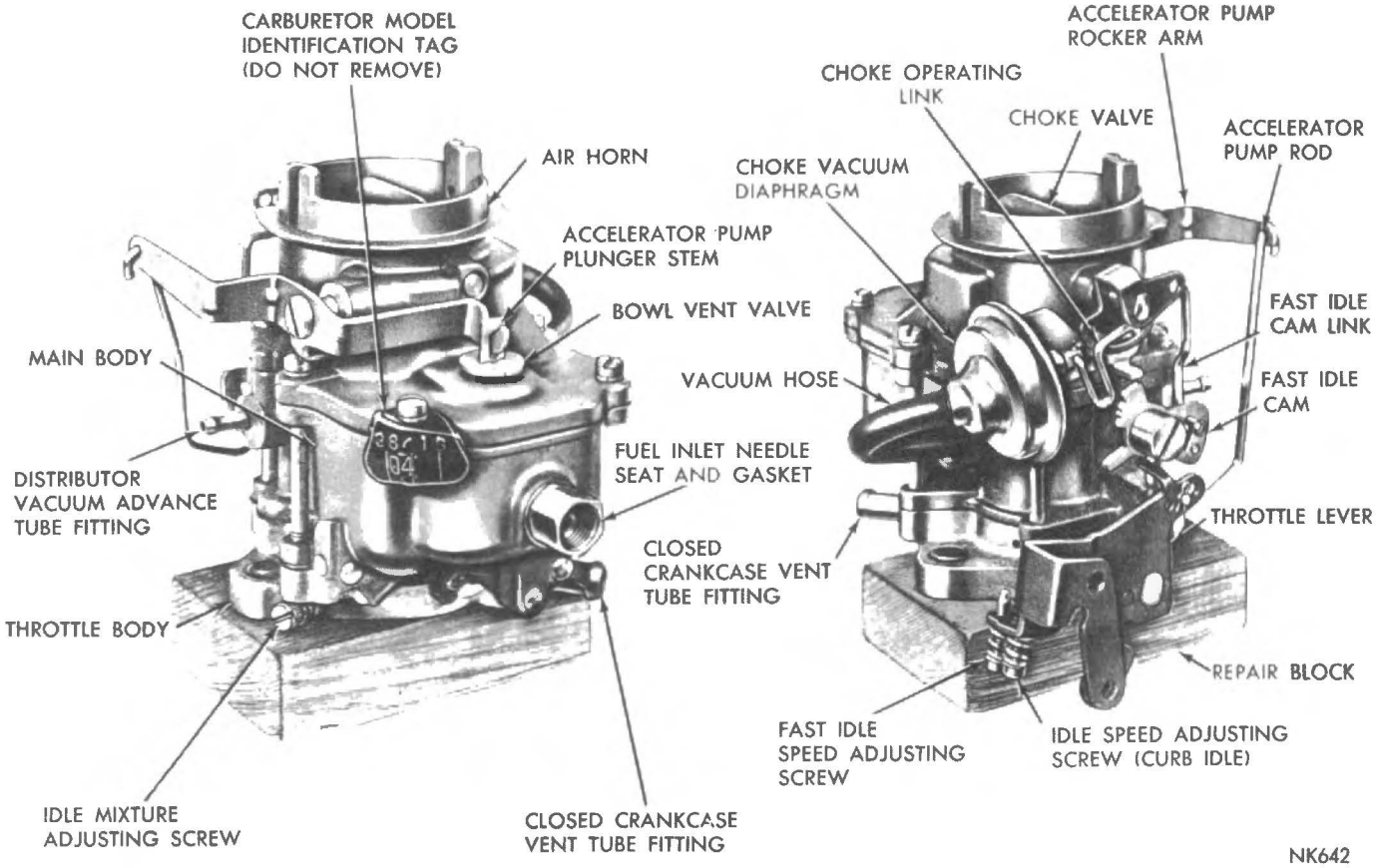


Fig. 2 - Carburettor Assembly BBS-3837S and BBS-3838S

cleaner may damage the diaphragm material.

(6) Remove the air horn retaining screws.

(7) Tilt the air horn toward the throttle lever far enough to disengage the fast idle cam link from the fast idle cam, as shown in (Fig. 3). Lift air horn up and away from main body. Discard the gasket.

(8) Disengage the accelerator pump plunger from the rocker arm, by pushing up on the bottom of the plunger and sliding plunger shaft off hook. Slide plunger out of air horn and remove bowl vent valve, spring seat and spring. If the old plunger can be used again, or if a new plunger is to be installed, place the plunger in a jar of clean gasoline or kerosene to prevent the leather from drying out.

(9) Lift out the float fulcrum pin retainer; then lift out the floats and fulcrum pin.

(10) Remove the fuel inlet needle valve, seat and gasket from the main body.

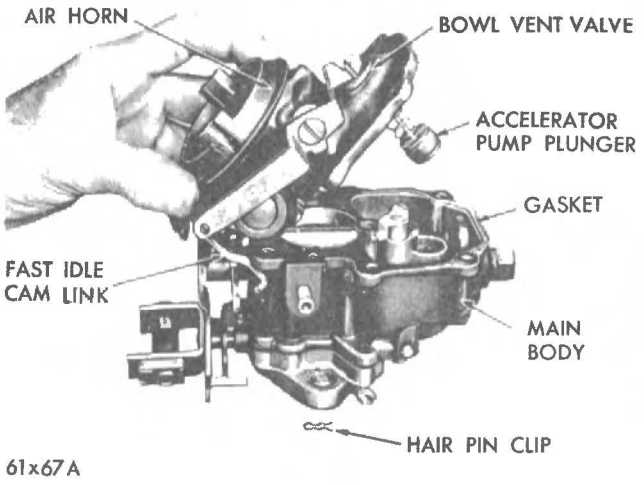


Fig. 3 - Removing or Installing Air Horn.

(11) Remove the step-up piston retaining screw, and slide step-up piston and rod out of well, as shown in (Fig. 4). Now lift out the step up piston ring. Remove the step-up piston gasket from the bottom of the well.

(12) Remove main metering jet and gasket (Fig. 5).

(13) Unscrew and remove idle orifice tube (Fig. 6).

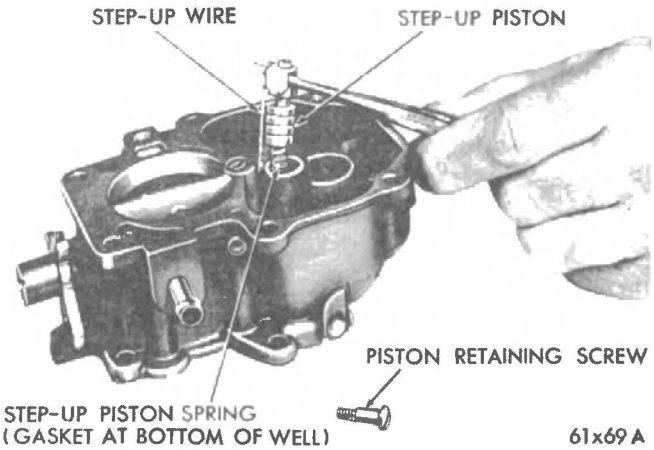


Fig. 4 - Removing or Installing Step-up Piston.

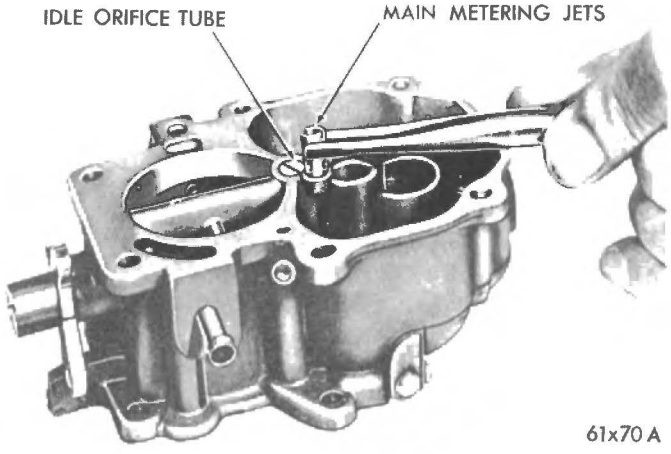


Fig. 5 - Removing or Installing Main Metering Jet.

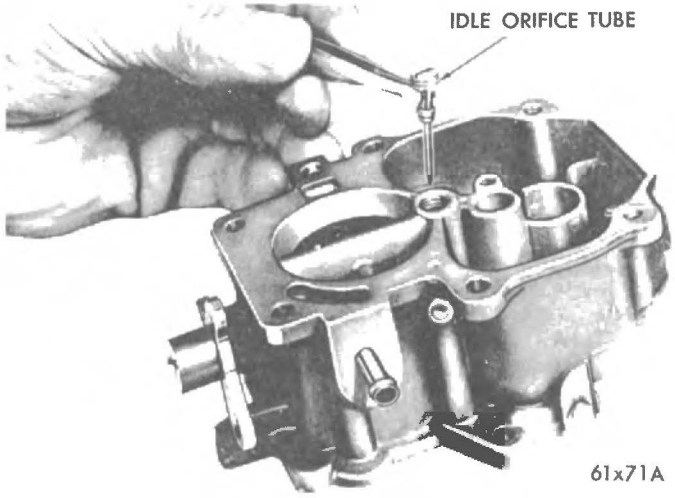


Fig. 6 - Removing or Installing Idle Orifice Tube.

(14) Invert the carburettor and drop out the accelerator pump check balls from their respective seats.

(15) Using Tool T109-43 plug remover, remove the accelerator pump jet plug. Using

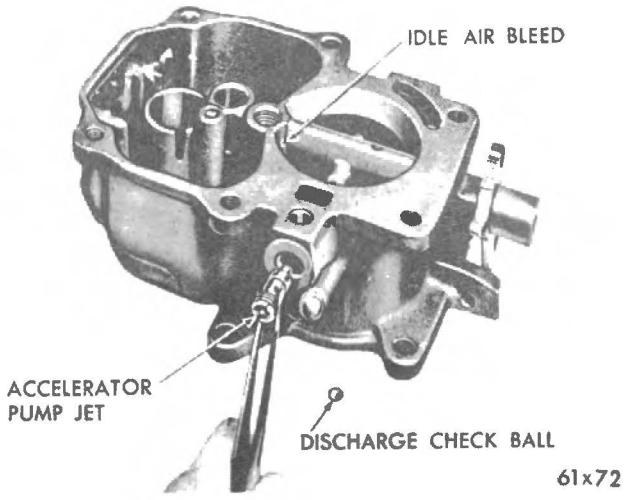


Fig. 7 - Removing or Installing Accelerator Pump Jet.

Tool T109-59T, remove the accelerator pump jet, as shown in (Fig. 7).

(16) Unscrew and remove the idle mixture adjusting screw and spring.

The carburettor has now been disassembled into three main units; air horn, main body and throttle body and the component parts of each disassembled as far as necessary for cleaning and inspection.

It is not advisable to remove the throttle shaft or valve from the throttle body, unless wear or damage necessitates the installation of new parts.

3. CLEANING CARBURETTOR PARTS

The recommended solvent for gum deposits is denatured alcohol which is easily obtainable. However, there are other commercial solvents which may be used with satisfactory results.

IMPORTANT: If the commercial solvent or cleaner requires the use of water as a rinse, it should be hot. After rinsing, all trace of water must be blown from the passages with air pressure. It is further advisable to rinse all parts in clean kerosene or petrol to be certain no trace of moisture remains. Never clean jets with a wire, drill or other mechanical means, because the orifice may become enlarged, making the mixture too rich for accurate performance.

4. INSPECTION AND REASSEMBLY

Throttle Body

(1) Check the throttle shaft for excessive wear in the throttle body. If wear is extreme, it is recommended that the throttle body assembly be replaced rather than installing a new shaft in the old body.

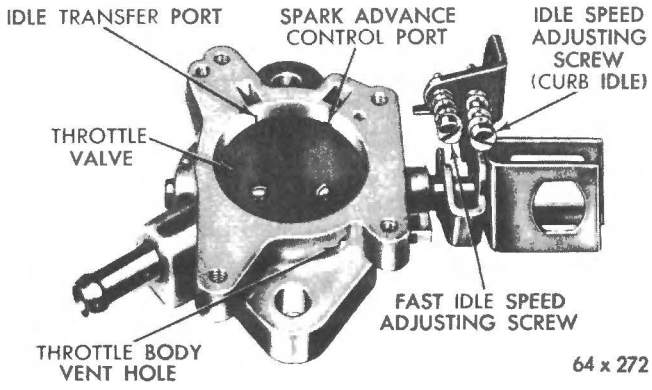


Fig. 8 - Ports in Relation to Throttle Valves

During manufacture, the location of the idle transfer port and the spark advance control ports to the throttle valve is carefully established for one particular assembly (See Fig. 8).

If a new shaft should be installed in an old worn throttle body, it would be very unlikely that the original relationship of the ports to the valve would be obtained. Changing the relationship of the valve to the ports would adversely affect normal car operation between the speeds of 15 and 30 miles per hour. If a new shaft or valve is to be installed, adhere to the following instructions.

(2) Mark the position of the throttle valve in the bore, so that it can be re-installed in the same position.

(3) Remove the screws that hold the throttle valve to the shaft, then slide the valve out of the bore.

CAUTION: These screws are staked on the opposite side and care should be used at removal so as not to break off in the shaft.

(4) Slide the throttle shaft out of the throttle body.

(5) Install new throttle shaft and lever (or new valve).

(6) Install NEW screws but do not tighten. Hold the valve in place, with the fingers pressing on the high side of valve. Tap the valve lightly with a screwdriver to set in the throttle bore. Now tighten the screws securely and stake by squeezing with pliers.

(7) Install the idle mixture screw and spring in the throttle body. (The tapered portion must be straight and smooth. If the tapered portion is grooved or ridged, a new idle mixture screw should be installed to ensure having correct idle mixture control). Do not use a screwdriver. Turn the screw lightly against its seat with the fingers. Back off 1 full turn for approximate adjustment.

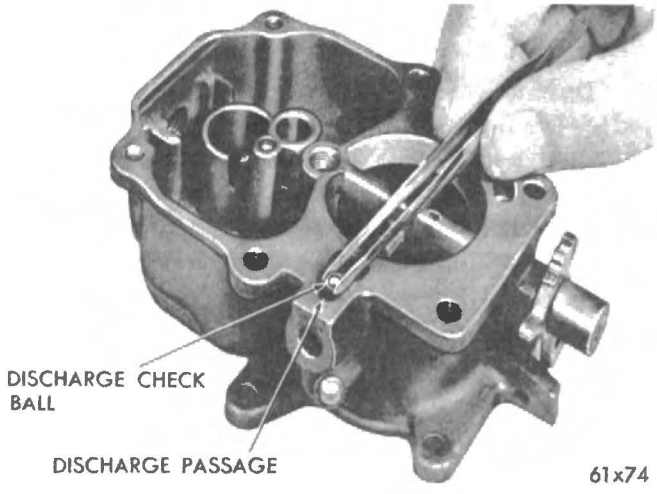


Fig. 9 - Installing Accelerator Pump Discharge Check Ball.

Main Body

(1) Install the accelerator pump discharge and intake check balls in their respective passages, as shown in Fig. 9.

To check the accelerator pump system, fuel inlet and discharge check balls proceed as follows:

(2) Pour clean petrol into the carburettor bowl, approximately $\frac{1}{2}$ inch deep. Remove the pump plunger from the jar of petrol and slide down into the pump cylinder. Raise the plunger and press lightly on the plunger shaft to expel air from the pump passage.

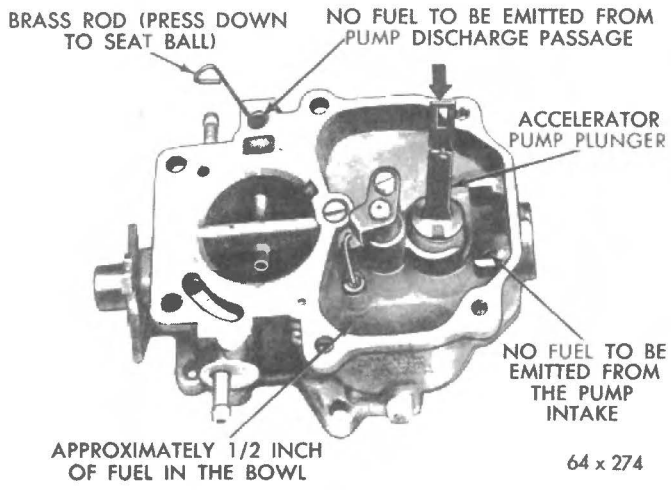


Fig. 10 - Testing Accelerator Pump Intake and Discharge Check Balls.

(3) Using a small clean brass rod, hold the discharge check ball down firmly on its seat. Again raise the plunger and press downward. No fuel should be emitted from either the intake or discharge passage, as shown in Fig. 10.

If any fuel does emit from either passage, it indicates the presence of dirt or a damaged check ball. Clean the passage again and repeat test. If leakage is still evident, install a NEW check ball. The fuel inlet check ball is located at the bottom of the plunger well.

(4) Install the accelerator pump jet, as in Fig. 7. Tighten securely using Tool T109-59T. Install a new plug and drive tightly in place.

(5) Install the idle orifice tube, (refer to Fig. 6). Tighten securely.

(6) Install the main metering jet and gasket, (refer to Fig. 5). Tighten securely.

(7) Before installing the step-up piston, be sure the step-up rod is able to move freely each side of the vertical position, as shown in Fig. 11. The step-up rod must be straight and smooth.

(8) Slide the step-up piston gasket down into position in the piston well, then install the step-up piston spring and step-up piston

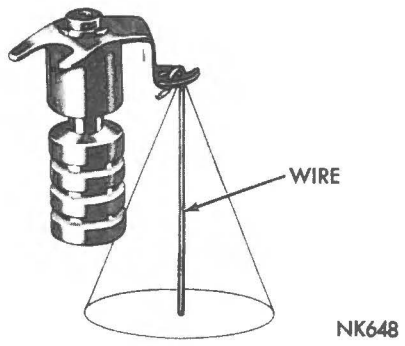


Fig. 11 -. Step up Piston Wire Free Play.

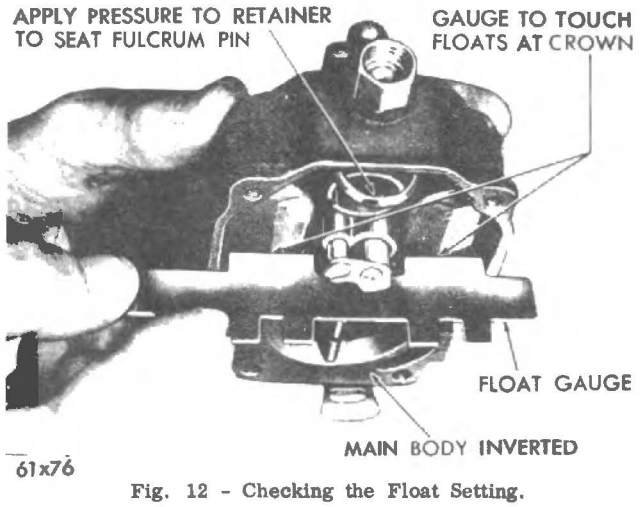


Fig. 12 - Checking the Float Setting.

and rod. (Refer to Fig. 4). Install retaining screw and tighten securely. Carefully guide the step-up rod into the main metering jet. Be sure the step-up piston slides freely in its cylinder. A step-up piston stuck in the UP position will cause a rich mixture at part throttle, whereas a piston stuck in the DOWN position will cause a lean mixture at wide open throttle and poor acceleration.

Checking Float Setting

The carburettors are equipped with a synthetic rubber tipped fuel inlet needle. The needle tip is rubber material which is not affected by petrol and is stable over wide range of temperatures. The tip is flexible enough to make a good seal on the needle seat.

The use of the new inlet needle requires a special procedure in adjusting the float setting. Care should be taken to perform this operation accurately in order to secure the best performance and fuel economy.

To correctly set the float height, when the carburettor is being overhauled, proceed as follows:

(1) Install the floats with the fulcrum pin and pin retainer in the main body.

(2) Install the needle, seat and gasket in the body and tighten securely.

(3) Invert the main body so that the weight of the floats only, is forcing the needle against the seat. Hold finger against retainer to fully seat the fulcrum pin.

(4) Using a T scale, check the float, as shown in Fig. 12 (refer to Specifications) from the surface of the fuel bowl to the crown of each float at the centre.

If an adjustment is necessary, bend the lip of the float lever either in or out until correct setting has been obtained.

CAUTION: Do not attempt to change the setting without removing the float, as the synthetic rubber tip can be compressed sufficiently to cause a false setting which will affect correct level of fuel in bowl.

After being compressed, the tip is very slow to recover its original shape. Recheck as described in Step 4 as above.

It is very important that the float lip be perpendicular to the needle or slanted not more than 10 degrees away from the needle when the float is set correctly.

(5) Place a new gasket on the throttle body and position the main body making sure they are aligned.

Air Horn

Check the freedom of the choke mechanism in the air horn. The shaft must float free to operate correctly.

(1) Assemble pump plunger, spring and spring seat and slide plunger shank through opening in air horn. Install bowl vent cap

over plunger shank, then engage with pump rocker arm. (Be sure the hairpin clip is in the middle position on the plunger rod.)

(2) Place a new gasket on the main body, then install air horn by tilting air horn, as shown in Fig. 3, in order to engage fast idle cam. After engaging link, slowly lower air horn and at the same time guide accelerator plunger into its well.

(3) Install air horn attaching screws. Tighten securely.

(4) Install the accelerator pump operating rod and secure with hairpin clip. Normal operation of the accelerator pump is obtained by installing pump rod in the centre hole of the throttle arm.

Choke Vacuum Diaphragm

Inspect the diaphragm vacuum fitting to ensure that the passage is not plugged with foreign material. Leak test the diaphragm to determine if it had internal leaks. To do this, first depress the diaphragm stem. Then place a finger over the vacuum fitting to seal the opening. Release the diaphragm stem. If the stem moves more than 1/16 inch in ten seconds, the leakage is excessive and the assembly must be replaced.

Install the diaphragm assembly on the air horn as follows:

(1) Assemble to the air horn and tighten the attaching screws securely.

(2) Install the choke operating link in position between the diaphragm plunger (stem) and the choke lever. Install the clip to secure.

(3) Inspect the rubber hose for cracks before placing it on the correct carburettor fitting. Refer to Fig. 2. Do not connect the vacuum hose to the diaphragm fitting until after the vacuum kick adjustment has been ade. (See Carburettor Adjustments).

5. CARBURETTOR ADJUSTMENTS

It is very important that the following adjustments be made on a reconditioned carburettor, and in the sequence listed:

Accelerator Pump and Bowl Vent

When assembling the accelerator pump to the air horn, note that the hairpin clip (which opens the bowl vent) can be placed in any one of the three positioning notches. These notches correspond to the long, medium and short pump stroke holes in the throttle lever. Normally, the bowl vent clip on the pump stem will be at the middle notch and the pump operating rod in the medium hole.

The proper procedure is to adjust the amount of bowl vent opening instead of measuring and setting the height of the pump plunger.

To check or set the adjustment, proceed as follows:

(1) Back off the idle adjusting screw. Open the choke valve, so that when the throttle valve is closed, the fast idle adjusting screw will not contact the fast idle cam.

(2) Be sure the pump operating rod is in the medium stroke hole in the throttle lever and that the bowl vent clip on the pump stem is in the centre notch.

(3) Close the throttle valve tightly. It should be just possible to insert a 1/16 inch drill (.060) between the bowl vent and the air horn, as shown in Fig. 13.

If an adjustment is necessary, bend the pump operating rod, using Tool T109-213, at the lower angle, until the correct bowl vent opening has been obtained.

This is an important adjustment, since too much lift at the bowl vent will result in considerable loss in low speed fuel economy.

Remember that if the pump operating rod is moved to either the short or the long stroke position, a corresponding change must be made in the location of the bowl vent clip, and the amount of lift of the bowl vent rechecked and adjusted.

The accelerator pump travel is automatically taken care of when the bowl vent is properly adjusted.

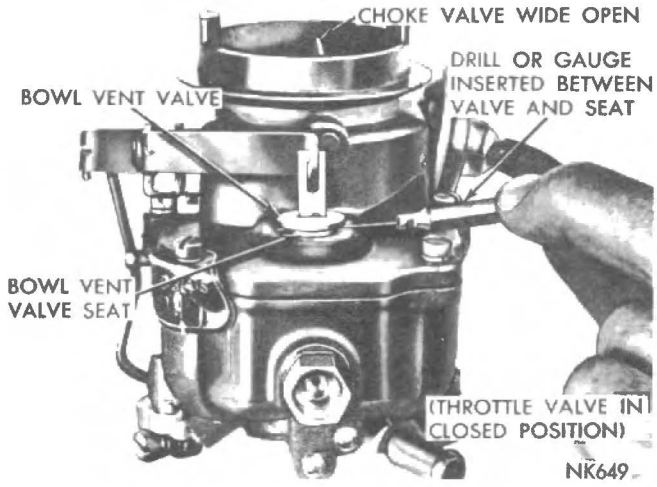


Fig. 13 - Checking Bowl Vent Opening.

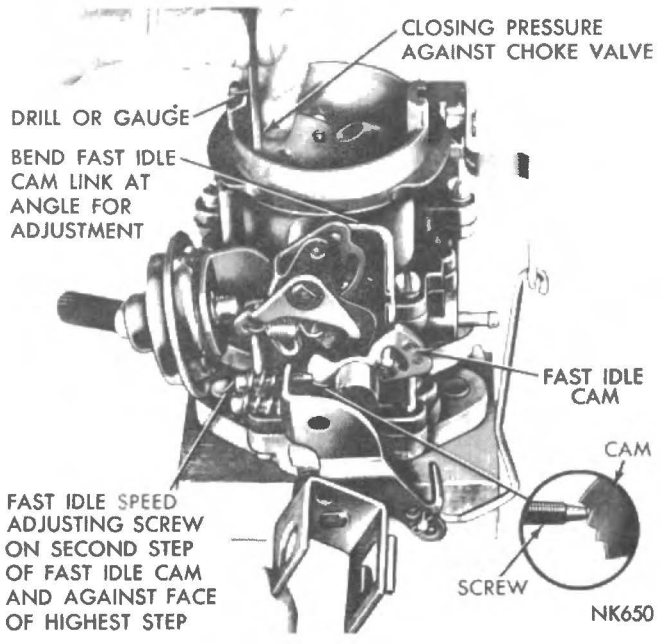


Fig. 14 - Fast Idle Cam Position Adjustment. (typical).

Fast Idle Speed and Cam Position

The fast idle engine speed and adjustment should be made on the vehicle, as described in the Fast Idle Speed Adjustment (On the Vehicle) Paragraph. However, the fast idle cam position adjustment can be made on the bench. This adjustment is important to assure that the speeds of each cam step occur at the proper time during engine warm-up. Adjust as follows:

(1) With the fast idle speed adjusting screw contacting the step on the fast idle cam shown in Fig. 14 move the choke valve toward the closed position with light pressure. Insert a drill or gauge between the choke valve and the wall of the air horn. (Refer to Specifications for Drill or Gauge Size).

(2) An adjustment will be necessary if a slight drag is not obtained as the drill or gauge is being removed.

(3) If an adjustment is necessary, bend the fast idle rod at the upper angle, using Tool T109-213, until the correct valve opening has been obtained. Refer to Fig. 14.

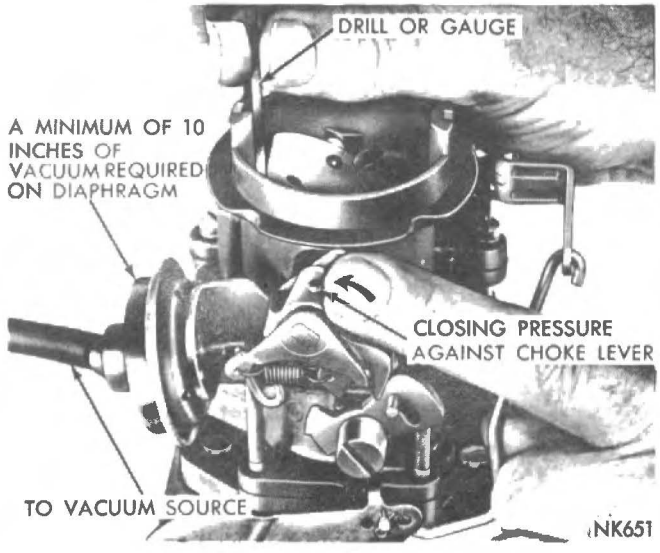


Fig. 15 - Vacuum Kick Adjustment (Typical).

Vacuum Kick Adjustment. (This test can be made ON or OFF the vehicle)

The choke diaphragm adjustment controls the fuel delivery while the engine is running. It positions the choke valve within the air horn by action of the linkage between the choke shaft and the diaphragm. The diaphragm must be energized to measure the vacuum kick adjustment. Use either a distributor test machine with a vacuum source, or vacuum supplied by another vehicle.

(1) With the engine NOT running, open the throttle valve far enough to allow the choke valve to be moved to the closed position.

(2) Disconnect the vacuum hose from the diaphragm and connect the hose from the vacuum supply, as shown in Fig. 15. A minimum of 10 inches of mercury (HG) will be required.

(3) Insert the specified drill or gauge between the choke valve and the wall of the air horn. Refer to Fig. 15. Apply sufficient closing pressure on the choke shaft lever to provide the smallest choke valve opening possible without distortion of the diaphragm link. Note that the cylindrical stem of the diaphragm will extend as an internal spring is compressed. The spring must be fully compressed for proper measurement of the kick adjustment.

(4) An adjustment will be necessary if a slight drag is not obtained as the drill or gauge is being removed.

The adjustment of this opening will require the removal of the choke operating link. DAMAGE TO THE DIAPHRAGM AND THE CHOKE LEVER SLOT CAN RESULT, IF THE LINK IS NOT REMOVED FOR THE BENDING OPERATION.

(5) Remove the clip and disengage the choke operating link from the diaphragm stem, then disengage the link from the choke lever. (The best bending results will be obtained by using a vice and a pair of pliers).

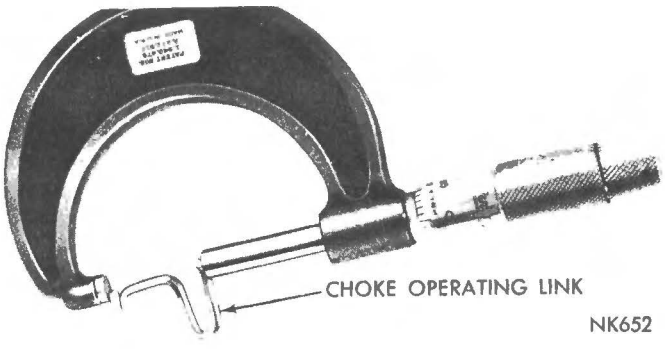


Fig. 16 - Choke Operating Link Measurements.

(6) Bend the choke operating link at the angle to provide the correct choke valve opening.

CAUTION: A correction in length of the link of .010 inch, will result in a change of .015 inch in the choke valve opening.

As an example, if the choke valve opening is 0.015 inch in error, the correction in the link length would be .010 inch.

A 2 inch micrometer will be helpful in establishing the original length of the link, as shown in Fig. 16 before completing the adjustment.

(7) Install the choke operating link and recheck the choke valve opening, using a gauge or drill (Fig. 15).

Reinstall the vacuum hose to the diaphragm and make the following check.

(8) With no vacuum applied to the diaphragm, some clearance should exist between the choke operating link and the choke lever slot, in both the open and closed choke valve positions, as shown in Fig. 17. This clearance is necessary to allow the choke valve to close for starting as well as fully open after the engine reaches the normal operating temperature.

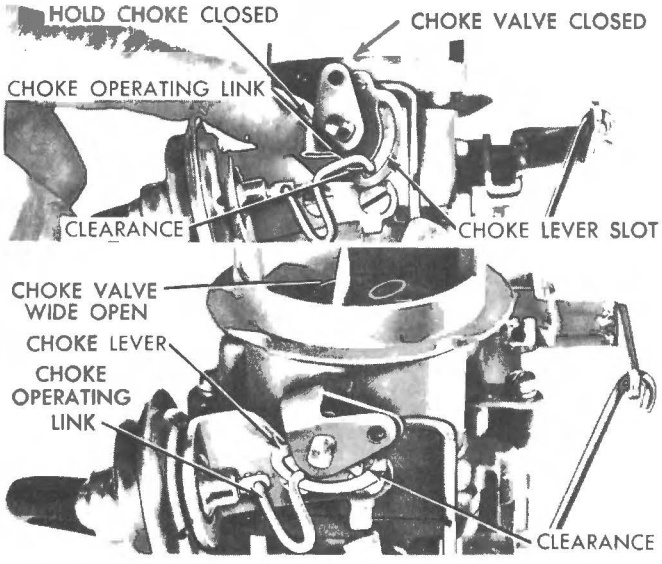


Fig. 17 - Choke Operating Link Clearances.

If a clearance does not exist in both of these positions a recheck of the operating link adjustment should be made. Free movement of the choke valve between the

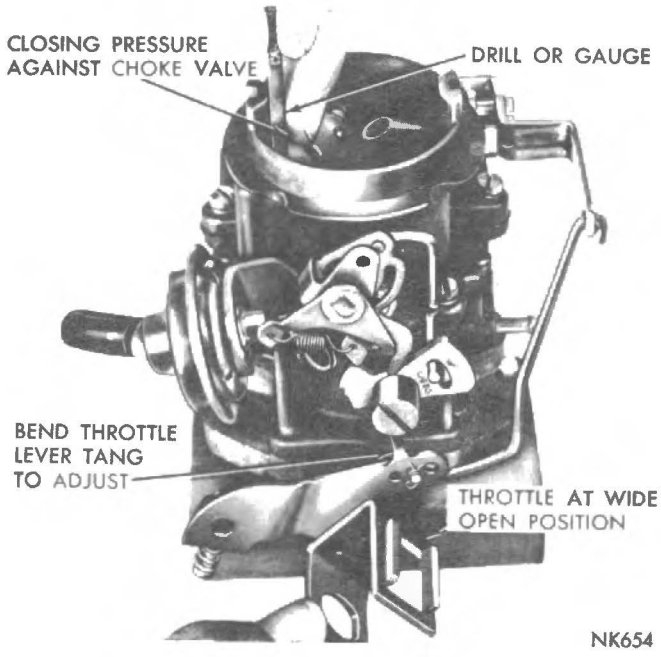


Fig. 18 - Checking the Choke Unloader Setting (wide open kick) (typical)..

closed and open positions is very necessary.

This free movement should also exist between the kick and the open choke valve positions with the engine running. If binding does exist, the choke operating link has been improperly bent and should be corrected.

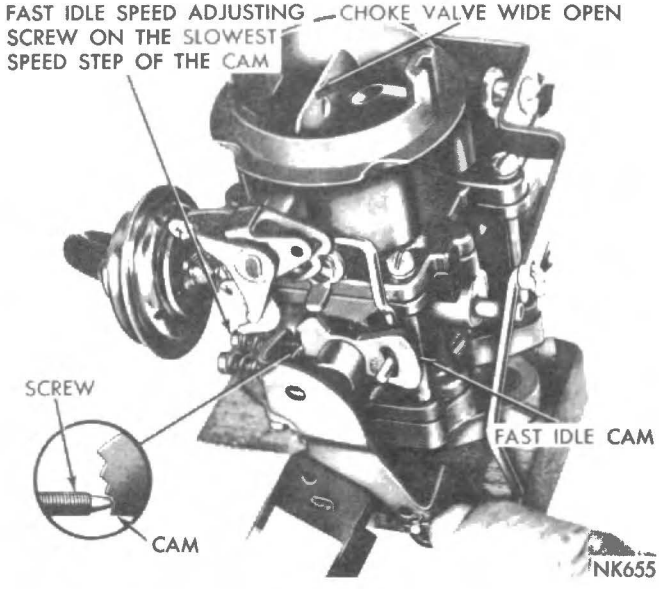


Fig. 19 - Fast Idle Speed Adjustment (on the vehicle) (Typical).

Choke Unloader (Wide Open Kick)

(1) Hold the throttle valve in the wide open position, insert Tool T109-28 or 3/16" drill between the upper edge of the choke valve and the inner wall of the air horn, as shown in Fig. 18.

(2) If no drag is felt, or if too much drag is apparent, bend the unloader tang on the throttle lever, until correct clearance has been obtained.

Idle Speed Adjustment (Curb Idle)

To make the idle speed adjustment, the engine must be thoroughly warmed up. A much more reliable idle adjustment can usually be obtained if the car has been driven a minimum of five miles. For the best results, it is recommended that a tachometer be used in this adjustment. (Before making the idle speed adjustment, observe the following precautions).

Because the alternator can charge at idle speeds and impose a load on the engine, the headlights should be turned on. This will assure setting the idle to compensate for the alternator load. On cars equipped with

automatic transmission disconnect the accelerator linkage from the transmission throttle lever. If this is not done, it is possible that the carburettor throttle will be held open against the stop in the transmission. The carburettor would therefore not respond to adjustment of the idle speed screw. After the proper idle speed has been obtained at the carburettor, reconnect the accelerator linkage to the transmission throttle lever and adjust as shown in paragraph 9.

To make the idle speed adjustment, proceed as follows:

(1) Turn the idle speed screw in or out to obtain 550 r.p.m. (Be sure that the choke valve is fully open and that the fast idle adjusting screw is not contacting the cam.)

(2) Adjust the idle mixture screw to obtain the highest r.p.m. While making the adjustment, carefully watch the tachometer and notice that the speed can be decreased by turning the screw in either direction from the setting that gave the highest r.p.m. reading.

(3) From the highest idle speed setting, turn the mixture screw clockwise (leaner) until the speed starts to drop. Turn the screw in the opposite direction (counter-clockwise) just far enough to recover the speed that was lost.

This procedure will assure that the idle has been set to the leanest mixture possible for smooth idle. This setting is very important.

Since the correct speed was originally set using the speed screw, the speed obtained after finding the leanest smooth idle setting will probably be too fast.

(4) Readjust the speed screw to obtain correct idle speed. Repeat steps 2 and 3 above.

Fast Idle Speed Adjustment (On the Car)

To set the fast idle speed on the car, connect a tachometer to the vehicle, then set the curb idle and proceed as follows:

(1) With the engine running, and the transmission in the neutral position, open the throttle slightly.

(2) Close the choke valve about 20 degrees then allow the throttle to close. Return the choke valve to the open position.

(3) The fast idle speed adjusting screw should be contacting the slowest speed step on the fast idle cam, as shown in Fig. 19.

(4) With the engine warmed up to the normal operating temperature, turn the fast idle speed adjusting screw in or out to secure 700 r.p.m. Reposition the cam and throttle after every screw adjustment to apply normal throttle closing torque.

Checking the Float Setting (On the Vehicle)

To check the float setting with the carburettor mounted on the vehicle, proceed as follows:

(1) Remove the accelerator pump operating rod.

(2) Remove two of the long air horn attaching screws and two short screws, then install the two short screws in place of the two long screws removed. This will hold the main body to the throttle body. Tighten screws securely.

(3) Remove the remaining air horn screws, then tilt the air horn far enough to disengage the fast idle cam link from the fast idle cam. Remove the air horn and gasket.

Check the float setting as follows:

(4) Seat the float fulcrum pin by pressing on the fulcrum pin retainer.

There should be enough fuel in the bowl to raise the float so that the lip bears firmly against the needle. Additional fuel may be admitted by slightly depressing the float. If the fuel pressure in the line is insufficient to force additional fuel into the bowl, add the necessary fuel from a clean container.

> CAUTION: Since the manifolds may be hot, it is dangerous to spill fuel on these surfaces. Therefore, take the necessary precautions to avoid spillage.

(5) With only the pressure of the buoyant float holding the float lip against the inlet needle, check the float setting, using Tool T109-239 or a "T" scale. (See Specifications). The measurement should be taken from the surface of the bowl (gasket removed) to the crown of the floats at the centre.

If an adjustment is necessary, hold the float on the bottom of the bowl, then bend the float lip toward or away from the needle. Recheck the setting again then repeat the lip bending operation as required.

CAUTION: When bending the float lip, do not allow the lip to push against the needle as the tip can be compressed sufficiently to cause a false setting which will affect correct level of the fuel in the bowl.

After being compressed, the tip is very slow to recover its original shape.

It is very important that the float lip be perpendicular to the needle or slanted not more than 10 degrees away from the needle when the float is correctly set.

(6) Reassemble the air horn as described previously.

7. AUTOMATIC CHOKE (WELL TYPE)

To function properly, it is important that all parts be clean and move freely. Other than an occasional cleaning, the choke requires no servicing. However, it is very important that the choke control unit works freely in the well and at the choke shaft. Move the choke rod up and down to check for free movement in the pivot. If the unit binds, a new choke unit should be installed.

NOTE: THE WELL TYPE CHOKE UNIT is serviced as an assembly. Do not attempt to repair, or change setting.

The correct setting is with the index notch opposite the No. 2 calibration mark on the rich side.

When installing the well type choke unit, be certain that the coil housing does not contact the sides of the well in the exhaust manifold. Any contact at this point will affect choke operation. DO NOT lubricate any parts of the choke or the control unit. This causes an accumulation of dirt which will result in binding of the mechanism.

8. CLOSED CRANKCASE VENT SYSTEM

The closed crankcase ventilator valve is located in the crankcase vent tube cap and is connected to the carburettor throttle body via a rubber tube (Fig. 1).

The function of the valve is to regulate the flow of unburned hydrocarbons from the crankcase and return them to the intake manifold. From here they enter the combustion chamber and exit via the exhaust system as completely burned exhaust products.

For servicing procedures of this valve, refer to Group 1 - Lubrication and Maintenance.

9. THROTTLE CABLE AND LINKAGE ADJUSTMENT (REFER FIG. 20)

Manual Transmission

(1) Apply a thin film of multi-purpose grease on both ends of the accelerator shaft (1) where it turns in the bracket (8), where it contacts the pedal, and bellcrank pin (2).

(2) Disconnect choke (3) at the carburettor or block choke valve in fully open position. Open the throttle slightly to release fast idle cam, then return carburettor to curb idle.

(3) Loosen the cable clamp nut (5), then adjust the position of the cable housing ferrule (4) in the clamp so that all slack is removed from the cable with the carburettor at curb idle. To remove slack from the cable, move the ferrule (4) in the clamp in the direction away from the carburettor lever.

(4) Back off ferrule (4) $\frac{1}{4}$ inch. This provides $\frac{1}{4}$" cable slack at idle.

Tighten cable camp nut (5).

(5) Connect choke rod (3) or remove blocking fixture.

Automatic Transmission

(1) Apply a thin film of multi-purpose grease on both ends of the accelerator shaft (1) where it turns in the bracket (8), where it contacts the pedal, and the bellcrank pin (2).

(2) Disconnect the transmission rod (6) from the bellcrank lever pin.

(3) Disconnect choke (3) at carburettor or block choke valve in full open position. Open the throttle slightly to release fast idle cam, then return carburettor to curb idle.

(4) Hold the transmission lever (7) forward against its stop (rod or lever must not be moved while holding against the stop) and adjust the length of the transmission rod by means of the threaded adjustment (6) at the upper end. The correct rod length allows the ball socket to line up with the ball end when the rod is held upward against the transmission stop.

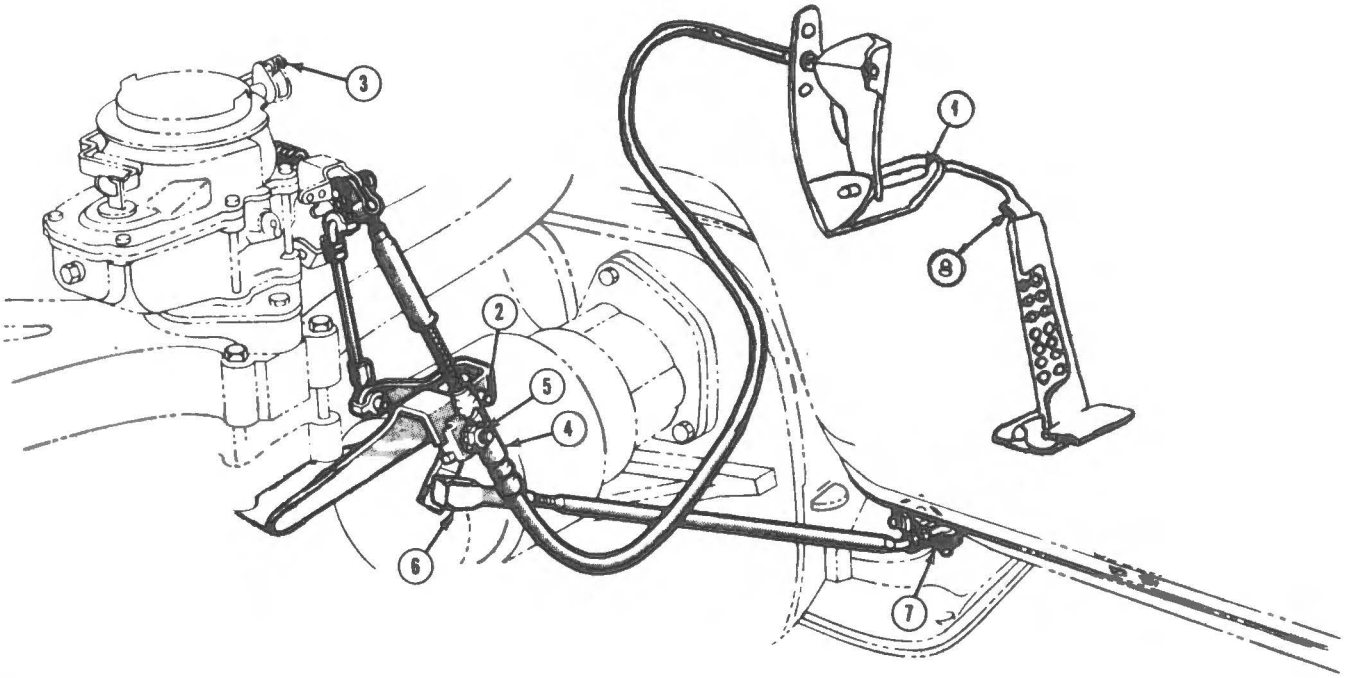
(5) Lengthen rod by one full turn of the adjustment and reconnect to bellcrank.

(6) Loosen the cable clamp nut (5), then adjust the position of the cable housing ferrule (4) in the clamp so that all slack is removed from the cable with the carburettor at curb idle. To remove slack from the cable, move the ferrule (4) in the clamp in the direction away from the carburettor lever.

(7) Back of ferrule (4) $\frac{1}{4}$ inch. This provides $\frac{1}{4}$" cable slack at idle. Tighten cable clamp nut (5).

(8) Route cable so that it does not interfere with the transmission rod throughout its full travel.

(9) Connect choke rod (3) or remove blocking fixture.



NK332

Fig. 20 - Throttle Linkage Adjustment
AP6 Models.

PART 3 — FUEL PUMP

SERVICE DIAGNOSIS

CONDITIONS — POSSIBLE CAUSES

1. FUEL PUMP LEAKS (FUEL)

(1) Loose housing screws.

(2) Worn, ruptured or torn diaphragm.

(3) Loose diaphragm mounting plates.

(4) Loose inlet or outlet line fittings.

2. FUEL PUMP LEAKS (OIL)

(1) Cracked or deteriorated pull rod oil seal.

(2) Loose rocker arm pivot pin.

(3) Loose pump mounting bolts.

(4) Defective pump to block gasket.

3. INSUFFICIENT FUEL DELIVERY

(1) Vent in tank filler neck restricted.

(2) Leaks in fuel line or fittings.

(3) Dirt or restriction in fuel tank.

(4) Worn, ruptured or torn diaphragm.

(5) Frozen fuel lines.

(6) Improperly seating valves.

(7) Vapour lock.

(8) Weak main spring.

(9) Restricted fuel filter.

4. FUEL PUMP NOISE

(1) Loose mounting bolts.

(2) Scored or worn rocker arm.

(3) Weak or broken rocker arm spring.

SERVICE INFORMATION — PROCEDURES

1. SERVICING THE FUEL PUMP

Model - M2996S

The fuel pump is driven by an eccentric cam that is cast on the camshaft in manufacture. As the camshaft rotates the eccentric cam presses down on the pump rocker arm. This action lifts the pull rod and diaphragm upwards against the fuel pump main spring, thus creating a vacuum in the valve housing, and opens the inlet valve, and fuel is drawn into the valve housing chamber. On the return stroke, the main-spring forces the diaphragm to the down position, which closes the inlet valve and expels the fuel in the valve housing chamber, through the outlet valve, to the fuel filter and the carburettor. The fuel filter should be renewed every 16,000 miles to ensure an unrestricted flow of fuel at all times. Do not attempt to clean.

2. TESTING THE FUEL PUMP (ON CAR)

If the fuel pump fails to supply fuel properly to the carburettor, the following tests should be made before removing the fuel pump from the vehicle.

Pressure Test

If leakage is not apparent, test pump for pressure as follows:

(1) Insert a "T" fitting in the fuel line at the carburettor as shown in Fig. 2.

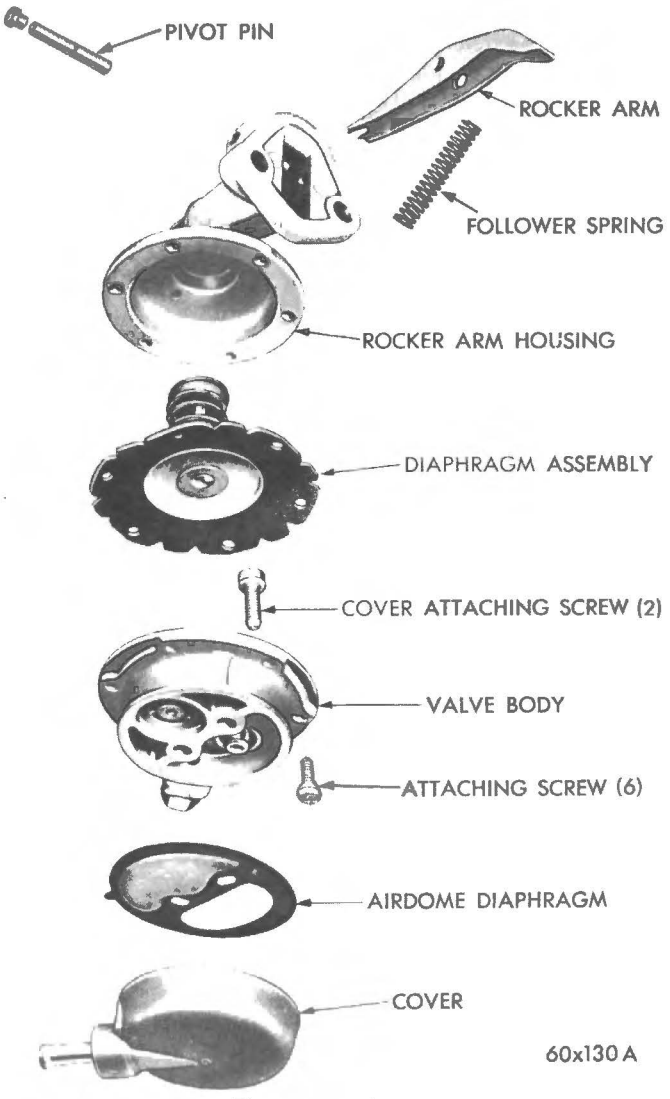


Fig. 1 - Fuel pump.

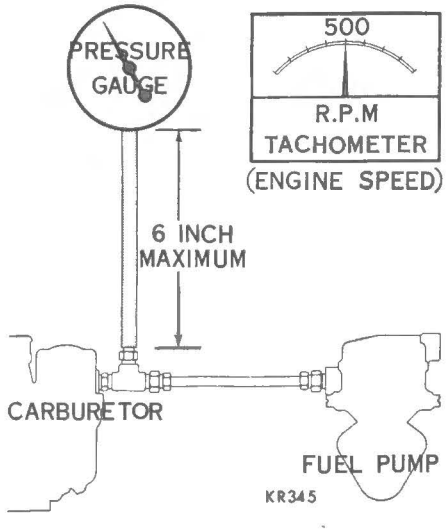


Fig. 2 - Pressure testing the fuel pump.

(2) Connect a 6" piece of hose between the "T" fitting and gauge C-3411. (The hose should not exceed 6" in length, a longer hose may collect fuel, and the additional weight of fuel would be added to the pressure of the pump and result in an inaccurate reading).

(3) Vent the pump for a few seconds (this relieves the air trapped in the fuel chamber). If this is not done, the pump will not operate at full capacity and low pressure reading will result.

(4) Connect a tachometer, then start the engine and run at 500 R. P. M. The reading should be from $3\frac{1}{2}$ to 5 p.s.i. and remain constant or return to zero very, very slowly when the engine is stopped.

An instant drop to zero indicates a leaking outlet valve. If the pressure is too low a weak diaphragm main spring or incorrect assembly of the diaphragm may be the cause. If the pressure is too high, the main spring is too strong.

Vacuum Test.

The vacuum test should be made with the fuel line disconnected from the carburettor. (This will allow the pump to operate at full capacity, which it must do to prime a dry carburettor).

Volume Test

The fuel pump should supply 2 pints of fuel in one minute or less at 500 R. P. M.

Inlet Valve Test

To test the inlet valve, connect a vacuum gauge on the inlet fitting whilst the line is disconnected:

(1) Start the engine or turn over with starting motor.

(2) There should be a noticeable vacuum present, not alternated by blowback.

(3) If blowback is present, the inlet valve is not seating properly and should be cleaned, or a new valve body installed. If the fuel pump does not perform to the above test requirements, it should be removed from the vehicle and overhauled as follows:

3. DISASSEMBLING THE FUEL PUMP

Before disassembling the fuel pump, mark the housings in such a manner that the inlet will be facing the inlet fuel line when re-assembled. This is important.

To disassemble the fuel pump for cleaning or overhaul, refer to Fig. 1 then proceed as follows:

(1) Remove the pivot pin plug, using Tool T109-43.

(2) Disengage the rocker arm follower spring from the rocker arm and rocker arm housing.

(3) Turn the pump on its side (pivot pin hole down) and tap gently to remove the pivot pin.

(4) Disengage the rocker arm from the diaphragm pull rod, by sliding rocker arm out of housing.

(5) Remove the screws that attach the valve body to the rocker arm housing. Separate the valve body and rocker arm housings, and lift out the diaphragm and pull rod assembly.

(6) Remove the screws that attach the valve body to the valve housing cover. Separate cover and valve body and remove the outlet air dome diaphragm.

4. CLEANING THE FUEL PUMP PARTS

Clean all fuel pump parts (except the diaphragm) in a suitable solvent, then blow dry with compressed air. Check the condition of the valve seats and parts for gum deposits. If the gum deposits are found, remove with denatured alcohol. If the valves are badly worn or damaged, install a complete new valve body assembly. The valves are not serviced individually.

5. REASSEMBLING THE FUEL PUMP

Examine the diaphragm for cracks, torn screw holes or ruptures. Check the rubber oil seal on the end of the pull rod for deterioration. Check the outlet air dome for cracks or deterioration. Check the rocker arm for scoring or galling on the camshaft eccentric bearing surface.

To reassemble the fuel pump, refer to Fig. 1 and proceed as follows:

(1) Place the air dome diaphragm in position on the valve body.

(2) Align the scribe marks on the cover and the valve body, then install attaching screws. Tighten securely.

(3) Slide the diaphragm pull rod up into the rocker arm housing. Place the valve body in position on the diaphragm with the scribe marks aligned. (Be sure that the holes in the diaphragm, rocker arm housing and valve bodies are aligned). Compress the unit together, then install the attaching screws, but DO NOT TIGHTEN. NEVER USE SHELLAC OR ANY OTHER ADHESIVE ON THE DIAPHRAGM.

(4) Slide the rocker arm into the housing and engage the diaphragm pull rod. Align the pivot pin holes in the arm with those in the housing, then install the pivot pin. Install new plug and drive in securely.

(5) Install the rocker arm follower spring over the tab on the rocker arm and over dimple in the housing.

(6) Place the pump in a vice (with protector jaws) then push on the rocker arm until full travel is reached. Hold in this position, whilst tightening the attaching screws. (This will prevent tearing of the diaphragm when the pump is in operation with the pump arm in its full stroke).

(7) Test the fuel pump as described previously.

6. FUEL PUMP — MS-3674S

Carter fuel pump MS-3674S as used on "V" Series AP5 and all AP6 models (see Fig. 3), is of pressed steel type and cannot be disassembled for service. If a pump malfunction occurs, remove the old pump and install a new one.

The fuel pump tests outlined for fuel pump model M-2996S should be conducted before removing the fuel pump from the vehicle.

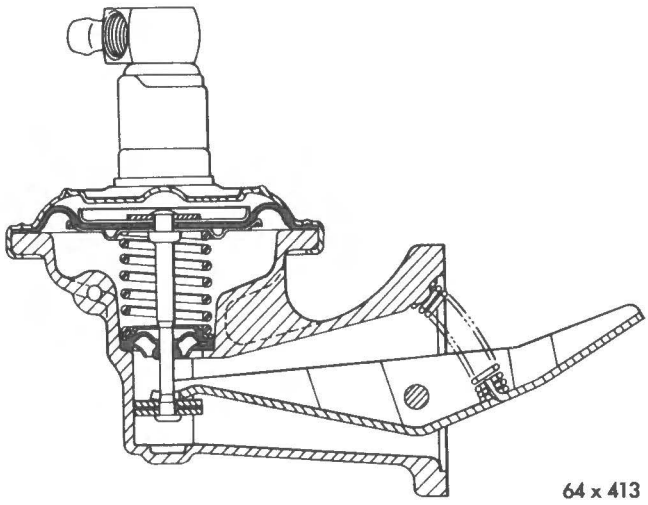


Fig. 3 - Fuel Pump Assembly (Sectional View).

PART 4 CARBURETTOR

V8 CYLINDER

SPECIFICATIONS

Carburettor:	
Type	Ball & Ball Dual Downdraft
Model	BBD-3844S
Bore	1 7/16"
Venturi	1 1/16"
Main Metering Jet:	
Standard	No. 120-294S
One Step Lean	No. 120-297S
Two Steps Lean	No. 120-298S
Step-Up Wire (Standard)	75-1645
Diameters (2 Stage)	.026" x .022"
Adjustments:	
Accelerator Pump Rod Position	Outer Hole of Rocker Arm
Float Setting (at centre of floats)	$\frac{1}{4}$"
Choke Unloader	$\frac{1}{4}$"
Fast Idle Cam Position	7/64"
Vacuum Kick (Drill Size)	No. 30
Bowl Vent Valve Setting (Throttle closed)	1/16"
Idle Mixture Screw (Turns Open)	1
Idle Speed R. P. M. (Curb Idle)	500
Fast Idle Speed R. P. M.	700
Choke:	
Type	Automatic Well Type
Control	Thermostat Coil Spring
Setting	On Index
Fuel Pump:	
Make and Model	Carter MS 3673S
Type	Diaphragm - Mechanical
Pressure	5 - 7 p.s.i.
Recommended fuel	Premium

GENERAL INFORMATION

I. DISASSEMBLY

To disassemble the carburettor for cleaning or overhaul proceed as follows:

(1) Place the carburettor assembly on repair block Tool C-3225.

(2) Remove the hairpin clips and disengage the accelerator pump operating rod. The accelerator pump rod is located in the outer hole of the accelerator pump rocker arm.

(3) Remove the hairpin clip and disengage the fast idle connecter rod from the fast idle cam and choke lever.

(4) Remove the vacuum hose between the carburettor main body and the vacuum diaphragm.

(5) Remove the clip from the choke operating link and disengage the link from the diaphragm plunger (stem) and the choke lever. Refer to (Fig. 1).

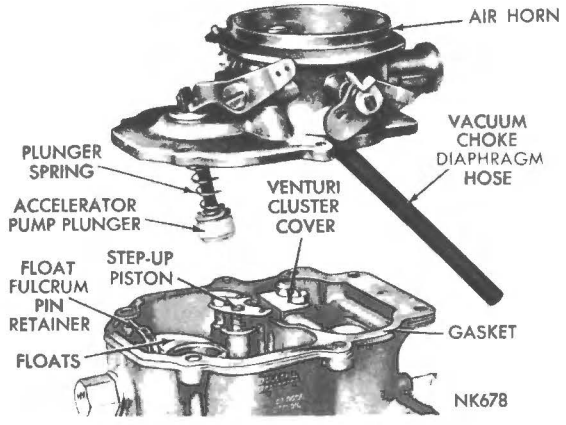


Fig. 1 Removing or Installing Air Horn

(6) Remove the choke vacuum diaphragm and bracket assembly and place to one side to be cleaned as a special item. A liquid cleaner may damage the diaphragm material.

(7) Remove the air horn retaining screws and lift air horn straight up and away from main body, as shown in (Fig. 1). Discard the gasket.

(8) Disengage the accelerator pump plunger from the rocker arm by pushing up on the bottom of plunger and sliding plunger shaft off hook. Slide plunger out of air horn and remove the bowl vent valve, spring seat and spring.

If the old plunger can be used again, or if a new plunger is to be installed, place the plunger in a jar of clean gasoline or kerosene to prevent the leather from drying out.

(9) Remove the fuel inlet needle valve, seat and gasket from the main body.

(10) Lift out the float fulcrum pin retainer, then lift out the floats and fulcrum pin.

(11) Remove the step-up piston retaining screw, and slide step-up piston and rods out of well, as shown in (Fig. 2). Now, lift out the step-up piston spring. Remove the step-up piston gasket from the bottom of the well.

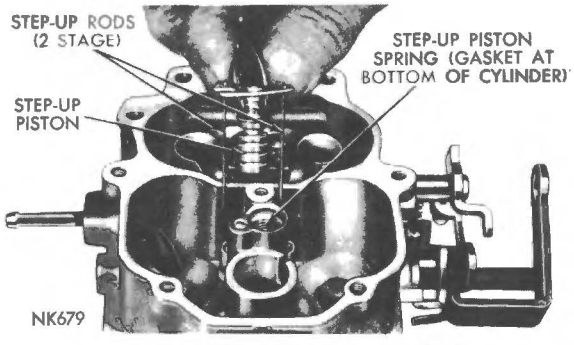


Fig. 2 Removing or Installing Step-up Piston

(12) Remove the main metering jets, as shown in (Fig. 3).

(13) Remove the venturi cluster screws, then lift the venturi cluster and gaskets up and away from main body, as shown in (Fig. 4). Discard the gaskets.

Do not remove the idle orifice tubes or main vent tubes from the cluster. They

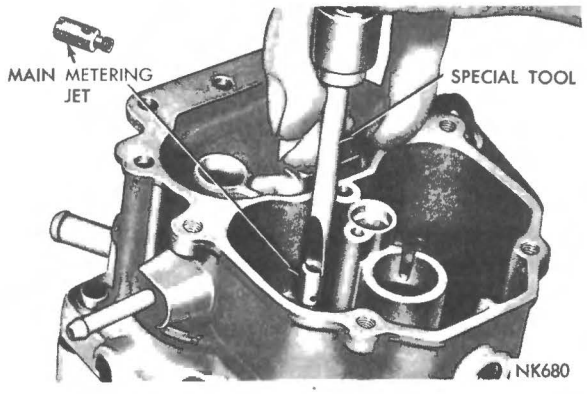


Fig. 3 Removing or Installing Main Metering Jets

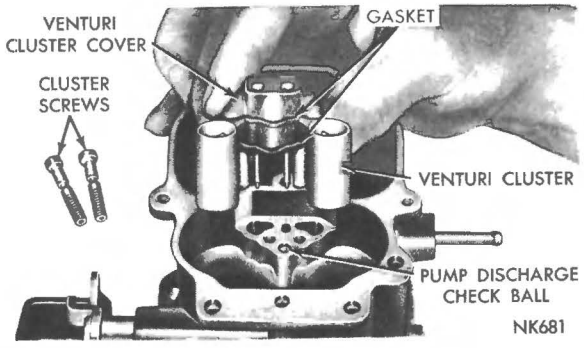


Fig. 4 Removing or Installing Venturi Cluster

can be cleaned in a solvent and dried with compressed air.

(14) Invert the carburettor and drop out the accelerator pump discharge and intake check balls.

(15) Remove the idle mixture adjusting screws and springs from the throttle body.

(16) Remove the screws that attach the throttle body to the main body. Separate the bodies.

(17) Test the freeness of the choke mechanism in the air horn. The choke shaft must float free to operate correctly. If the choke shaft sticks in the bearings, or appears to be gummed from deposits in the air horn, a thorough cleaning will be required.

The carburettor now has been disassembled into three main units, namely the air horn, main body and throttle body and the component parts of each disassembled as far as necessary for cleaning and inspection.

It is usually not advisable to remove the throttle shaft or valves from the throttle body, unless wear or damage necessitates the installation of new parts.

2. INSPECTION AND ASSEMBLY

Throttle Body

(1) Check the throttle shaft for excessive wear in the throttle body. (If wear is extreme, it is recommended that the throttle body assembly be replaced rather than installing a new shaft in the old body).

During manufacture, the location of the idle transfer port and the spark advance control ports to the throttle valve, is carefully established for one particular assembly. (See Fig. 5).

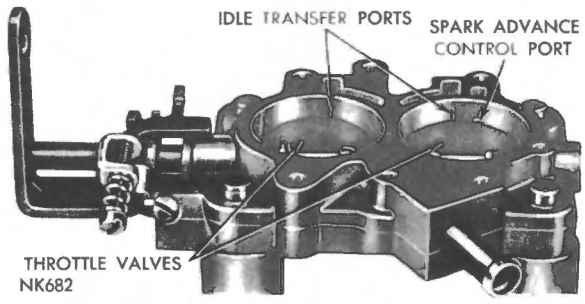


Fig. 5 Ports in Relation to Throttle Valves

If a new shaft should be installed in an old, worn throttle body, it would be very unlikely that the original relationship of the ports to the valves would be obtained. Changing the relationship of the valves to the ports would adversely affect normal car operation between the speeds of 15 and 30 miles per hour. However, if it has been determined that a new shaft or valves is to be installed, adhere to the following instructions.

(2) Mark the position of the throttle valves to the shaft, then slide the valves out of the bores.

CAUTION: These screws are staked on the

opposite side and care should be used at removal so as not to break off in the shaft.

(3) Slide the throttle shaft out of the throttle body. Remove the fast idle speed screw lever.

(4) Slide the fast idle speed screw lever over new throttle shaft and insert into throttle body.

(5) Install throttle valves in their respective bores (with the valve numbers toward manifold flange). Install NEW screws but do not tighten. Hold the valves in place, with the fingers pressing on the high sides of the valves. Tap the valves lightly with a screwdriver to seat valves in the throttle bores. Tighten the screws securely and stake by squeezing with pliers.

(6) Install the idle mixture screws and springs in the throttle body. (The tapered portion must be straight and smooth. If the tapered portion is grooved or ridged, new idle mixture screws should be installed to ensure having correct idle mixture control). Do not Use a Screwdriver.

Turn the screws lightly against their seats with the fingers, back off 1 full turn for approximate adjustment.

Main Body

(1) Invert the main body and place the insulator in position, then place the throttle body on main body and align. Install screws and tighten securely.

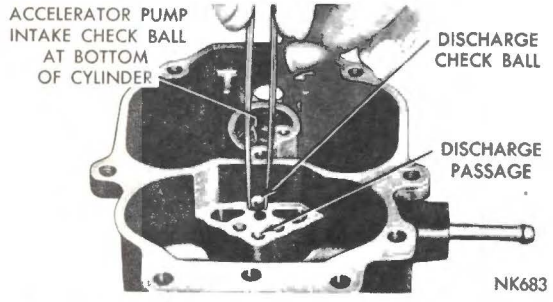


Fig. 6 Installing Accelerator Pump Discharge Check Ball

(2) Install the accelerator pump discharge check ball (5/32 inch diameter) in the discharge passage, as shown in (Fig. 6). Drop the accelerator pump intake check ball (3/16 inch diameter) into the bottom of the pump cylinder.

To check the accelerator pump system; fuel inlet and discharge check balls, proceed as follows :

(3) Pour clean gasoline into the carburettor bowl, approximately $\frac{1}{2}$ inch deep. Remove the pump plunger from the jar of gasoline and slide down into the pump cylinder. Raise the plunger and press lightly on the plunger shaft to expel air from the pump passage.

(4) Using a small clean brass rod, hold the discharge check ball down firmly on its seat. Again raise the plunger and press downward. No fuel should be emitted from either the intake or discharge passage, as shown in (Fig. 7).

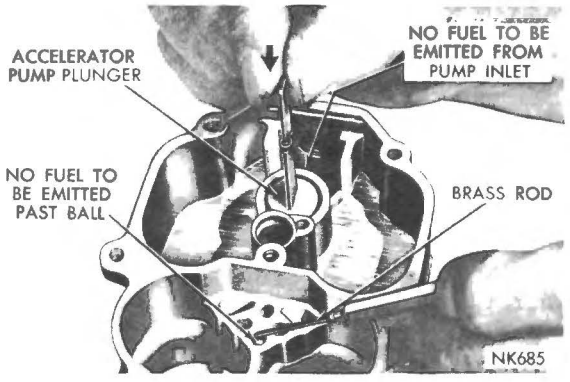


Fig. 7 Testing Accelerator Pump Intake and Discharge Check Balls

If any fuel does emit from either passage, it indicates the presence of dirt or damaged check ball or seat. Clean the passage again and repeat test. If leakage is still evident, install new check balls. The fuel inlet check ball is located at the bottom of the plunger well. Remove fuel from bowl.

(5) Install new gaskets on venturi cluster, then install in position in the main body. Refer to (Fig. 4). Install the cluster screws and tighten securely.

(6) Install the main metering jets and tighten securely. Refer to (Fig. 3).

(7) Before installing the step-up piston, be sure the step-up rods are able to move freely each side of the vertical position, as shown in (Fig. 8). The step-up rods must be straight and smooth.

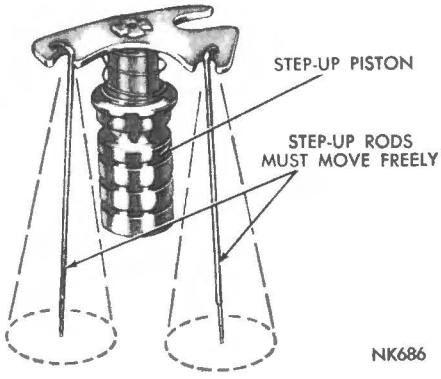


Fig. 8 Step-up Piston and 2 Stage Rods

(8) Slide the step-up piston gasket down into position in the piston well, then install the step-up piston spring and step-up piston and rods. Carefully guide the step-up rods into the main metering jets. Refer to (Fig 2). Install retaining screw and tighten securely.

A step-up piston stuck in the UP position will cause a rich mixture at part throttle, whereas a piston stuck in the DOWN position will cause a lean mixture at wide open throttle and poor acceleration.

Measuring the Float Setting

The carburettors are equipped with a synthetic rubber tipped fuel inlet needle. The needle tip is a rubber material which is not affected by gasoline and is stable over a wide range of temperatures. The tip is flexible enough to make a good seal on the needle seat, and to give increased resistance to flooding.

The use of new inlet needle requires a new procedure in adjusting the float setting. Care should be taken to perform this accurately in order to secure the best performance and fuel economy.

To correctly set the float height, when the carburettor is being overhauled, proceed as follows :

(1) Install the floats with the fulcrum pin and pin retainer in the main body.

(2) Install the needle, seat and gasket in the body and tighten securely.

(3) Invert the main body (catch the pump intake check ball) so that the weight of the floats only, is forcing the needle against the seat. Hold finger against retainer to fully seat the fulcrum pin.

(4) Using Tool T109-282 or a "T" scale, check the float, as shown in (Fig. 9). There should be $\frac{1}{4}$ inch from the surface of the fuel bowl to the crown of each float at the centre.

If an adjustment is necessary, hold the floats on the bottom of the bowl and bend the float lip toward or away from the needle. Recheck the $\frac{1}{4}$ inch setting again then repeat the lip bending operation as required.

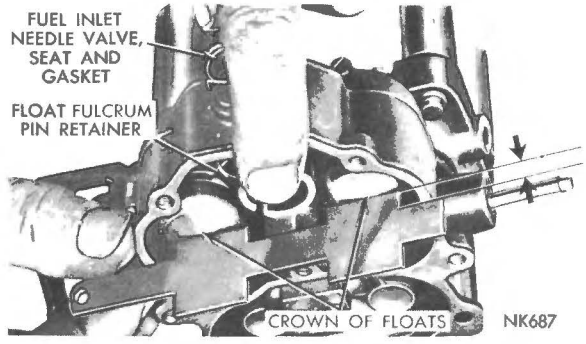


Fig. 9 Measuring the Float Setting

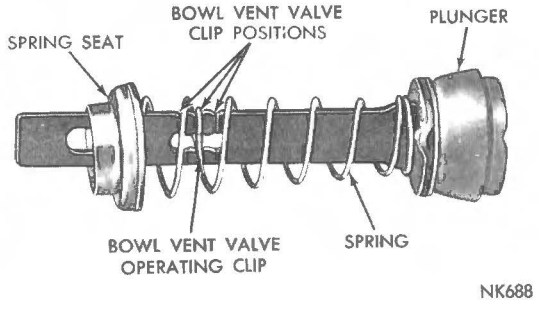


Fig. 10 Accelerator Pump Assembly

CAUTION: When bending the float lip, do not allow the lip to push against the needle as the synthetic rubber tip can be compressed sufficiently to cause a false setting which will affect correct level of fuel in the bowl.

After being compressed, the tip is very slow to recover its original shape.

It is very important that the float lip be perpendicular to the needle or slanted not more than ten degrees away from the needle when the float is set correctly.

Air Horn

(1) Assemble the pump plunger, spring and spring seat, as shown in (Fig. 10). Slide plunger shaft through opening in air horn. Install bowl vent valve over plunger shaft, then engage with pump rocker arm.

(2) Place a new gasket on the main body, then install the air horn. Refer to (Fig. 1). Install attaching screws and tighten securely. (When installing air horn be sure the leather on the plunger does not fold back).

(3) Engage the fast idle connector rod in the choke lever and fast idle cam. Secure with hairpin clip.

(4) Engage the accelerator pump operating rod in the outer hole in the rocker arm and in the centre hole in the throttle lever. Install clips to secure.

Choke vacuum diaphragm

Inspect the diaphragm vacuum fitting to ensure that the passage is not plugged with foreign material. Leak check the diaphragm to determine if it has internal leaks. To do this, first depress the diaphragm stem, then place a finger over the vacuum fitting to seal the opening. Release the diaphragm stem. If the stem moves more than 1/16 inch in 10 seconds, the leakage is excessive and the assembly must be replaced.

Install the diaphragm assembly on the airhorn as follows:

(1) Assemble to the airhorn and tighten the attaching screws securely.

(2) Install the choke operating link in position between the diaphragm plunger (stem) and the choke lever. Install the clip to secure.

(3) Inspect the rubber hose for cracks before placing it on the correct carburettor fitting. Do not connect the vacuum hose to the diaphragm fitting until after the vacuum kick adjustment has been made. (See Carburettor Adjustments).

3. Adjustments

It is very important that the following adjustments be made on a reconditioned carburettor, and in the sequence listed.

Accelerator Pump and Bowl Vent.

When assembling the accelerator pump to the air horn, note that the hair pin clip (which opens the bowl vent) can be placed in any one of the three positioning notches. These notches correspond to the long, medium and short pump stroke holes in the throttle lever. Normally, the bowl vent clip on the pump stem will be at the middle notch and the pump operating rod in the medium stroke hole.

The proper procedure is to adjust the amount of bowl vent opening instead of measuring and setting the height of the pump plunger.

To check or set the adjustment proceed as follows :-

(1) Back off the idle speed adjusting screw. Open the choke valve so that the fast idle cam allows the throttle valves to be completely seated in the bores.

(2) Be sure the pump operating rod is in the medium stroke hole in the throttle lever, and that the bowl vent clip on the pump stem is in the centre notch.

(3) Close the throttle valves tightly. It should be just possible to insert a 1/16 inch drill between the bowl vent and its seat, as shown in (Fig. 11).

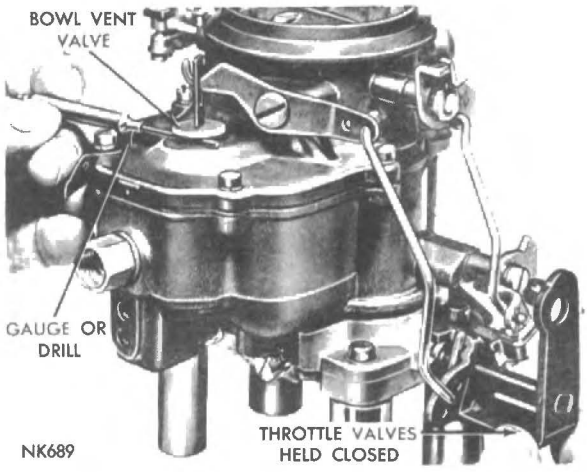


Fig. 11 Measuring Bowl Vent Opening

If an adjustment is necessary, bend the pump operating rod, using Tool T109-213, at the lower angle, until the correct bowl vent opening has been obtained.

This is an important adjustment, since too much lift at the bowl vent will result in considerable loss in low speed fuel economy.

Remember that if the pump operating rod is moved to either the short or long stroke position, a corresponding change must be made in the location of the bowl vent clip, and the amount of lift of the bowl vent rechecked and adjusted.

Fast Idle Speed and Cam Position Adjustment.

The fast idle engine speed adjustment should be made on the vehicle, as described in the Fast Idle Speed Adjustment (On the Vehicle) Paragraph. However, the Fast Idle Cam Position Adjustment can be made on the bench. This adjustment is important to be sure that the speeds of each cam step occur at the proper time during the warm-up. Adjust as follows:

(1) With the fast idle speed adjusting screw contacting the step on the fast idle cam shown in (Fig. 12), move the choke valve toward the closed position with light pressure. Insert a 7/64 inch drill or gauge between the choke valve and the wall of the air horn.

(2) An adjustment will be necessary if a slight drag is not obtained as the drill or gauge is being removed.

(3) If an adjustment is necessary, bend the stop of the shaft lever, using Tool T109-22, until the correct valve opening has been obtained. Refer to (Fig. 12).

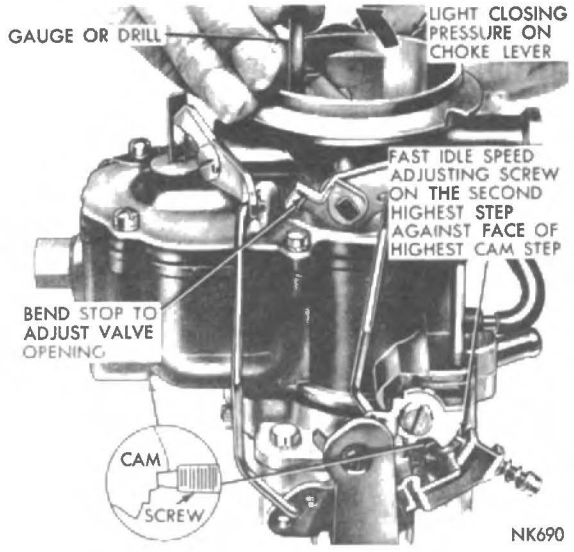


Fig. 12 Fast Idle Cam Position Adjustment

Vacuum Kick Adjustment - (This test can be made On or Off the vehicle)

The choke diaphragm adjustment controls the fuel delivery while the engine is running. It positions the choke valve within the air horn by action of the linkage between the choke shaft and the diaphragm. The diaphragm must be energized to measure the vacuum kick adjustment. Use either a distributor test machine with a vacuum source or vacuum supplied by another vehicle. Adjust as follows :

(1) With the engine NOT running, open the throttle valves far enough to allow the choke valve to be moved to the closed position.

(2) Disconnect the vacuum hose from the diaphragm and connect the hose from the vacuum supply as shown in Fig. 13. (A minimum of 10 inches of mercury will be required).

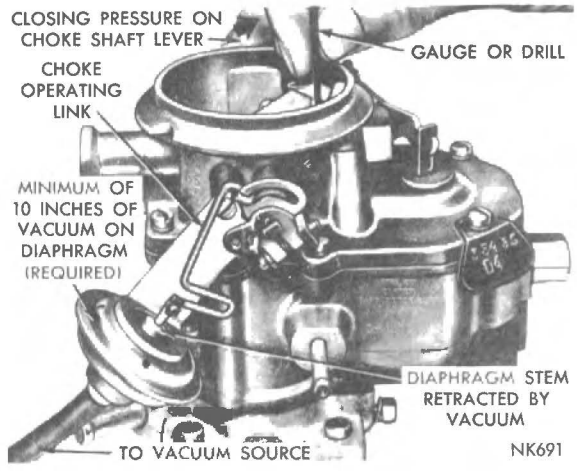


Fig. 13 Measuring the Choke Vacuum Kick Setting

(3) Insert the specified No. 30 drill or gauge between choke valve and the wall of the air horn. Apply sufficient closing pressure on the choke shaft lever to provide the smallest choke valve opening possible without distortion of the diaphragm link. Note that the cylindrical stem of the diaphragm will extend as an internal spring is compressed. The spring must be fully compressed for proper measurement of the kick adjustment.

(4) An adjustment will be necessary if a slight drag is not obtained as the drill or gauge is being removed.

The adjustment of this opening will require the removal of the choke operating link.

CAUTION: Damage to the diaphragm and the choke lever slot can result, if the link is not removed for the bending operation.

(5) Remove the clip and disengage the choke operating link from the diaphragm stem, then disengage the link from the choke lever. (The best bending results will be obtained by using a vice and a pair of pliers).

(6) Bend the choke operating link at the angle to provide the correct choke valve opening.

CAUTION: A correction in the length of the link of .010 inch, will result in a change of .015 inch in the choke valve opening.

As an example, if the choke valve opening is 0.015 inch in error, the correction in the link length would be .010 inch.

A 2 inch micrometer will be helpful in establishing the original length of the link, as shown in (Fig. 14), before completing the adjustment.

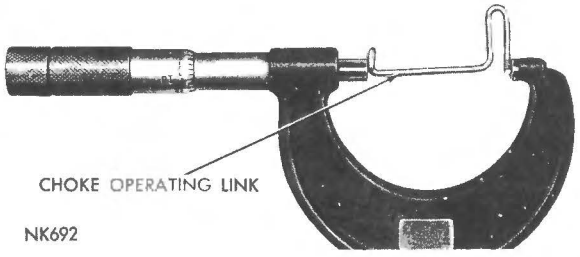


Fig. 14 Choke Operating Link Measurements

(7) Install the choke operating link and recheck the choke valve opening, using a gauge or drill. Refer to (Fig. 13).

(8) Reinstall the vacuum hose to the diaphragm and with no vacuum applied to the diaphragm. Some clearance should exist between the choke operating link and the choke lever slot, in both the open and closed choke valve positions, (as shown in Fig. 15). This clearance is necessary to allow the choke valve to close for starting as well as fully open after the engine reaches the normal operating temperature.

If a clearance does not exist in both of these positions, a recheck of the operating link adjustment should be made.

Free movement of the choke valve between the closed and open positions is very necessary.

This free movement should also exist between the kick and the open choke valve

positions with the engine running. If binding does exist, the choke operating link has been improperly bent and should be corrected.

Choke Unloader (Wide Open Kick)

(1) Hold the throttle valves in the wide open position. Insert Tool T109-31 or $\frac{1}{4}$" drill shank between the upper edge of the choke valve and the inner wall of the air horn, as shown in (Fig. 16).

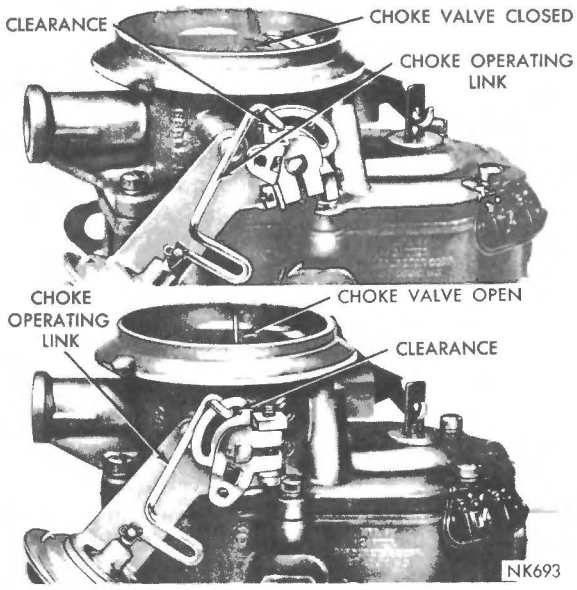


Fig. 15 Choke Operating Link Clearances

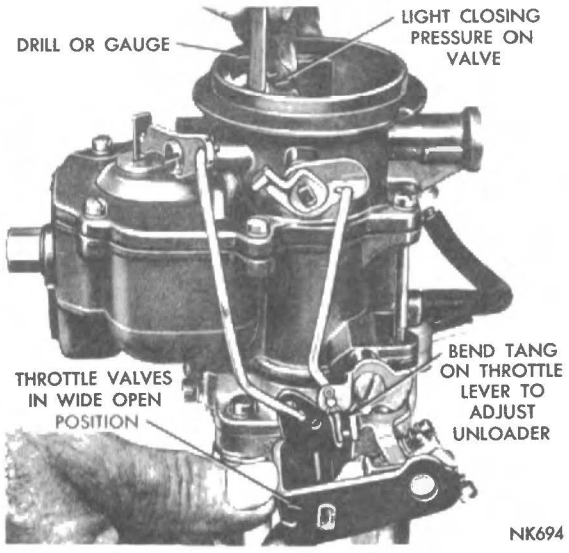


Fig. 16 Measuring the Choke Unloader Setting

(2) If no drag is felt, or if too much drag is apparent, bend the unloader, tang on the throttle lever, until correct clearance has been obtained.

Idle Speed Adjustment (Curb Idle)

To make the idle speed adjustment, the engine must be thoroughly warmed up. A much more reliable idle adjustment can usually be obtained if the car has been driven a minimum of five miles. For the best results, it is recommended that a tachometer be used in this adjustment. (Before making the idle speed adjustment, observe the following precautions):

Because the alternator can charge at idle speeds and impose a load on the engine, the headlights should be turned on (high beam). This will assure setting the idle to compensate for the alternator load. Disconnect the transmission control rod from the ball joint on the carburettor lever so that the stop in the transmission will not interfere with the free movement of the carburettor throttle lever.

(1) Turn the idle speed screw in or out to obtain 500 r.p.m. Be sure that the choke valve is fully open and that the fast idle adjusting screw is not contacting the fast idle cam.

(2) Turn each idle mixture screw to obtain the highest r.p.m. While making the adjustment, watch the tachometer and notice that the speed can be decreased by turning the screws in either direction from the setting that gave the highest r.p.m. reading.

(3) Readjust to 500 r.p.m. with the idle speed screw.

(4) Turn each idle mixture adjusting screw in the clockwise direction (leaner) until there is a slight drop in r.p.m. Now, turn each screw out counter-clockwise (richer) just enough to regain the lost r.p.m.

This procedure will assure that the idle has been set to the leanest mixture

possible for smooth idle.
This setting is very important.

Since the correct speed was originally set using the speed screw, the speed obtained after finding the leanest smooth idle setting will probably be too fast.

(5) Readjust the speed screw to obtain correct idle speed. Repeat steps 2 and 4 if necessary. After the proper idle speed has been obtained, refer to Fig. 18 of the Throttle Linkage Adjustment for the procedure on adjusting the transmission control rod.

Fast Idle Speed

To set the fast idle speed on the car, connect a tachometer, then set the curb idle speed and proceed as follows:

(1) With the engine running and the transmission in the neutral position, open the throttle slightly.

(2) Close the choke valve about 20 degrees then allow the throttle to close. Return the choke valve to the open position.

(3) The fast idle speed adjusting screw should be contacting the slowest speed step on the fast idle cam, as shown in (Fig. 17).

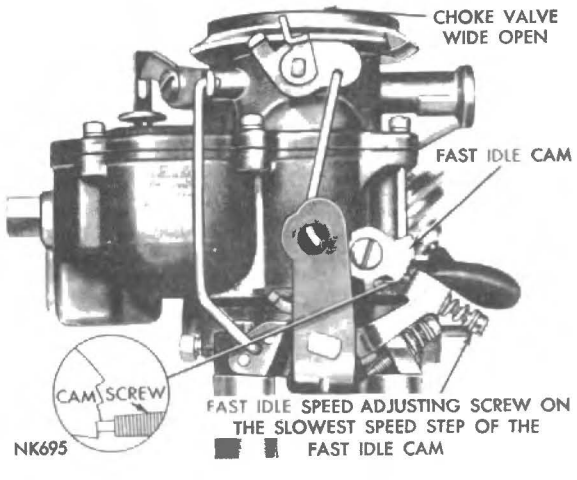


Fig. 17 Fast Idle Speed Adjustment (on the vehicle)

(4) With the engine warmed-up to the normal operating temperature, turn the fast idle speed adjusting screw in or out to secure 700 r.p.m. Reposition the cam and throttle after every screw adjustment to apply normal throttle closing torque.

Throttle Linkage Adjustment (Refer Fig. 18)

(1) Apply a thin film of multi-purpose grease to both ends of the accelerator shaft (3) where it turns in the bracket, and bottom side of the pedal (4) where it contacts accelerator shaft lever. Also to pivot points of both upper (5) and lower (6) bellcranks, and the clipped ends of transmission linkage rod bearing areas. (14) (15) and (16).

(2) Disconnect the return spring and carburettor rod ball socket (1) from carburettor or disconnect the transmission intermediate rod ball socket (2) from the upper bellcrank ball end.

(3) Disconnect choke (7) at carburettor or block choke valve in full open position. Open throttle slightly to release fast idle cam, then return carburettor to curb idle.

(4) Insert a 6 inch long 3/16 inch diameter rod (8) in the holes provided in the upper engine mounted bellcrank (5) and lever, adjust the length of the intermediate transmission rod by means of the threaded adjustment (9) at the upper end. The ball socket must line up with the ball end with the rod held downward against the transmission stop (10).

(5) Assemble ball socket (2) to bell end and remove 3/16 inch rod (8) from upper bellcrank (5) and lever.

(6) Hold the carburettor rod (11) forward against the transmission stop (10) and adjust its length by means of the threaded adjustment (11) so that the ball socket (1) lines up with the ball end of the carburettor lever.

(7) Lengthen carburettor rod four

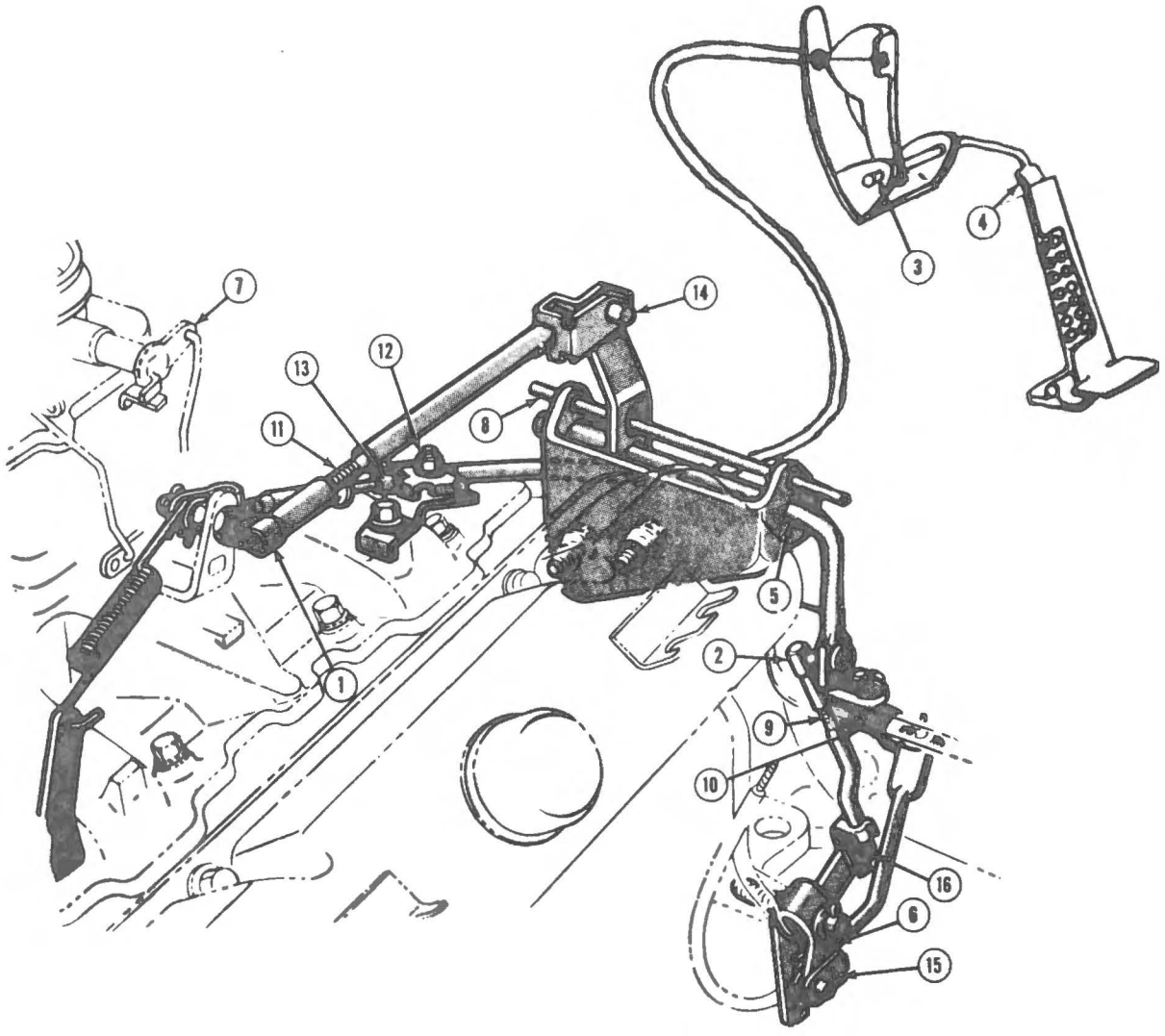


Fig. 18 Throttle and Transmission Linkage Adjustment

turns by turning ball socket (1) counter-clockwise.

(8) Assemble ball socket (1) to ball end and connect the return spring.

(9) Loosen the cable clamp nut (12), then adjust the position of the cable housing ferrule (13) in the clamp so that all slack is removed from the cable with the carburettor at curb idle. To remove slack from the cable move the ferrule (13) in the clamp in the direction away from the carburettor lever.

(10) Back off ferrule (13) $\frac{1}{4}$ inch. This provides $\frac{1}{4}$ inch cable slack at idle. Tighten cable clamp nut (12).

(11) Route cable so that it does not interfere with the transmission rod throughout its full travel.

(12) Connect choke rod (7) or remove blocking fixture.

PART 5 — FUEL TANK

SERVICE INFORMATION ..... PROCEDURES

WARNING: When working on fuel tanks, be sure the ignition is switched off.

The fuel tank is located at the rear of the body under the trunk compartment floor (Fig. 1). The filler tube is accessible through the centre of the deck opening lower panel.

NOTE: If the vehicle is to be stored for any appreciable length of time, the fuel should be drained from the entire system in order to prevent gum formation. If the vehicle should have been undercoated, be sure that the tank vent tube is open. If this vent is plugged, a collapsed fuel tank will result.

The fuel tank is fitted with a gauge unit, including the suction pipe.

The filter on the end of the suction pipe is a replaceable unit and prevents the entry of water or foreign material. When installing a tank unit, be sure the filter is pushed down on the pipe until seated.

1. REMOVING THE FUEL TANK

Should it become necessary to remove the fuel tank, proceed as follows:

(1) Drain the fuel tank dry by disconnecting the fuel line at the pump and then connect a syphon tube, and syphon the fuel into a suitable container. Disconnect the fuel line and the wire lead to the gauge unit.

(2) Disconnect the vent tube from the filler tube at the connector.

(3) Remove the three screws that hold the filler tube and gasket to the rear quarter panel.

(4) Remove the 5 screws and washers that attach the filler tube seal to the floor pan, then remove the end of the vent tube from the seal.

(5) Grasp the filler tube with both hands, twist the tube, and at the same time, force downward into the tank, until the end of the tube clears the quarter panel. Remove the gasket. (If the tube is "frozen" in the tank, use a rubber lubricant around the joint and work into the "O" ring recess, after sliding the dust shield out of the way).

(6) Twist (or rotate) the filler tube approximately 180°, then work tube carefully out of the tank and dust shield seal. Remove tube from the inside of the trunk compartment.

CAUTION: Do not pull the tube from side to side, or up and down, as rough treatment can cause the soldered sleeve to break its seal to the tank and thus cause a leak.

(7) Remove the nut that holds the tank retaining strap to the "J" bolt. Allow strap to drop or hang, then lower the tank and remove from under the car.

(8) Remove the tank gauge unit, using spanner C-3582. Slide the gauge assembly out of the fuel tank. Discard the gasket.

(9) If necessary, check the operation of the fuel gauge, as described in Group 8 of this manual.

2. INSTALLING FUEL TANK

Before installing the fuel gauge, check the condition of the filter on the end of the suction tube. If the filter is plugged, install a new filter. To install the fuel tank refer to Fig. 1 and proceed as follows:

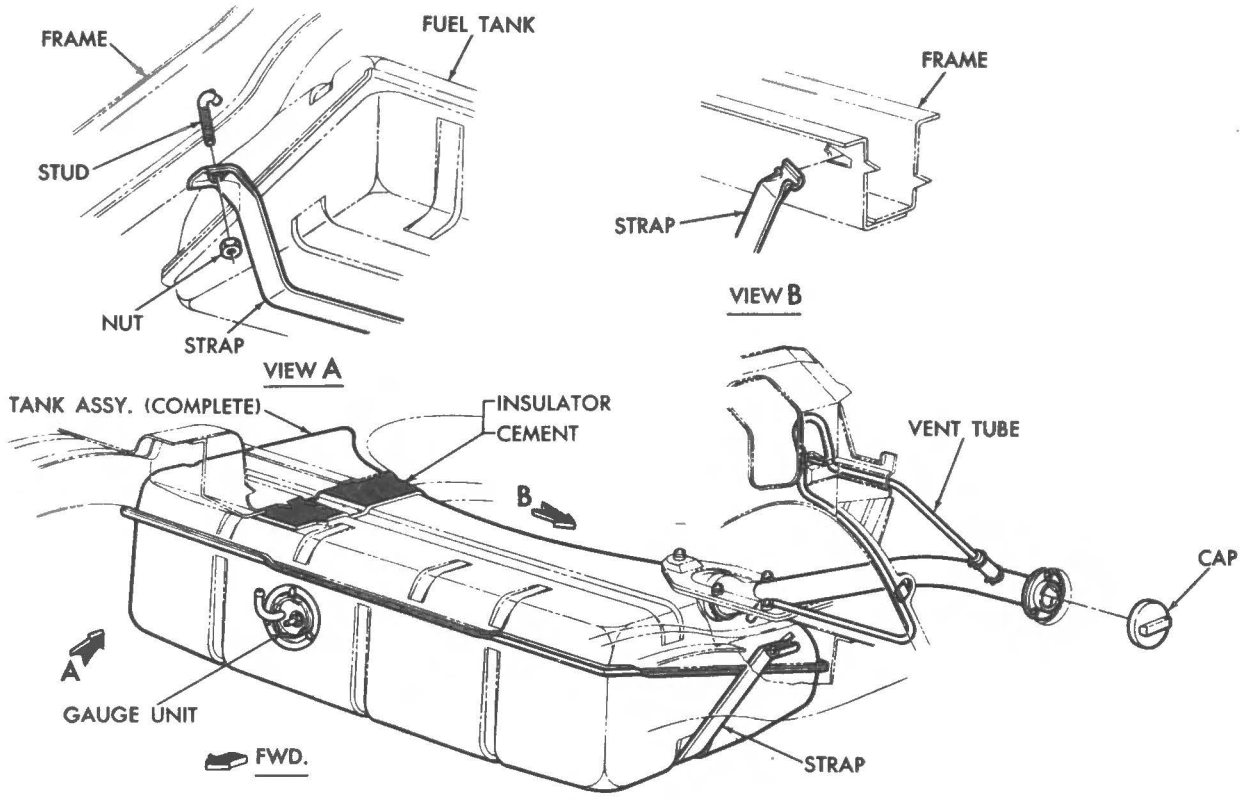


Fig. 1 - Fuel tank assembly.

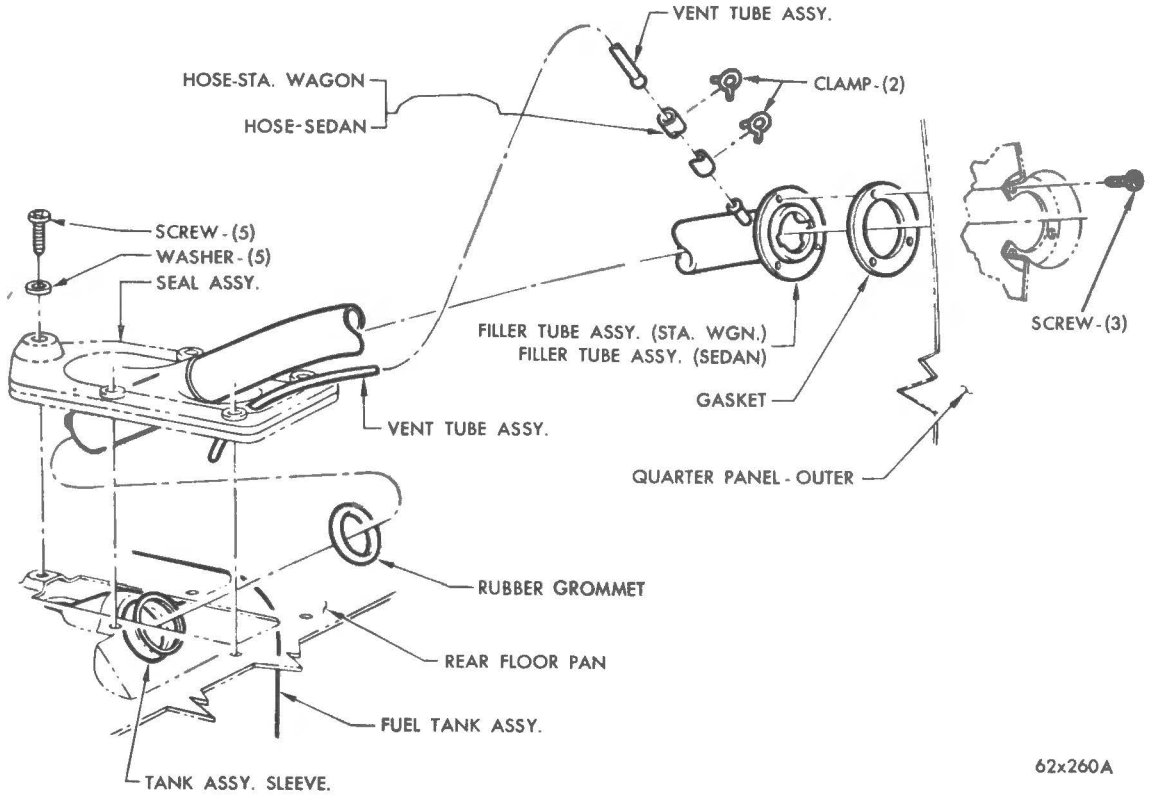


Fig. 2 - Filler tube assembly (exploded view).

(1) Install a new "O" ring in the tank filler tube sleeve. Insert a new gasket in the fuel gauge opening recess, then slide gauge into tank. Align the positioning tangs on the gauge with those in the tank. Install the lockring, then tighten securely using Tool C-3582.

(2) Slide the tank under the car and up in position, then raise the retaining strap and thread onto the "J" bolt. Install the attaching nut, and tighten securely. (Not over 60 lb./in.).

(3) Lubricate the "O" ring, using a suitable rubber lubricant, then slide the filler tube down through the dust seal and into the tank, far enough to clear the quarter panel. Twist (or rotate) the filler tube 180° and align with opening in quarter panel. Install a new gasket over end of tube, then, slowly withdraw tube from tank and into position against quarter panel. Align attaching screw holes; install screws and tighten securely. Slide vent tube through seal.

(4) If dust seal was disturbed during removal operation, realign and tighten attaching screws securely.

(5) Reconnect the vent tube to the filler tube connector.

(6) Reconnect the fuel supply line and the wire lead to the gauge.

(7) Refill the tank and check for leaks.